THE IRON AGE

Established 1855 New York, May 29, 1913 *Vol. 91: No. 22*

Steel Castings from the Electric Furnace

Modified Heroult Installation of the Treadwell Engineering Company, Easton, Pa.—Characteristics of Castings of Varying Carbon Content

BY EDWIN F. CONE

Considerable has been heard of steel castings produced in electric furnaces in Europe and some data have been published on their excellent qualities. But practically nothing has been said about such castings as produced in the United States, chiefly because very little has been done commercially. Only recently has the regular production of steel castings from an electric furnace on a commercial scale been undertaken by a domestic company in competition with other producers of small steel castings.

A few years ago, when the Treadwell Engineering Company, Easton, Pa., was organized, it absorbed the Lebanon Steel Casting Company, Lebanon, Pa., which was producing castings by the crucible process. Not satisfied with this method and desiring to increase its output, the new company recently began to look about for a better process. After extended investigation, and with reference to the fact that users of high grade castings were importing electric furnace products into this country, it was decided to install a Heroult furnace. The first heat was poured August 14, 1911.

The Furnace

Difficulties were encountered and many problems had to be solved before successful and uninterrupted production was achieved. The furnace as operated today is shown in Figs. 1 and 2, the latter illustrating a portion of the foundry. Though of the Heroult design, this has been modified in several particulars to adapt it to the production of steel for castings. It is rectangular in shape, with a charging door on each side and a tapping spout in front.

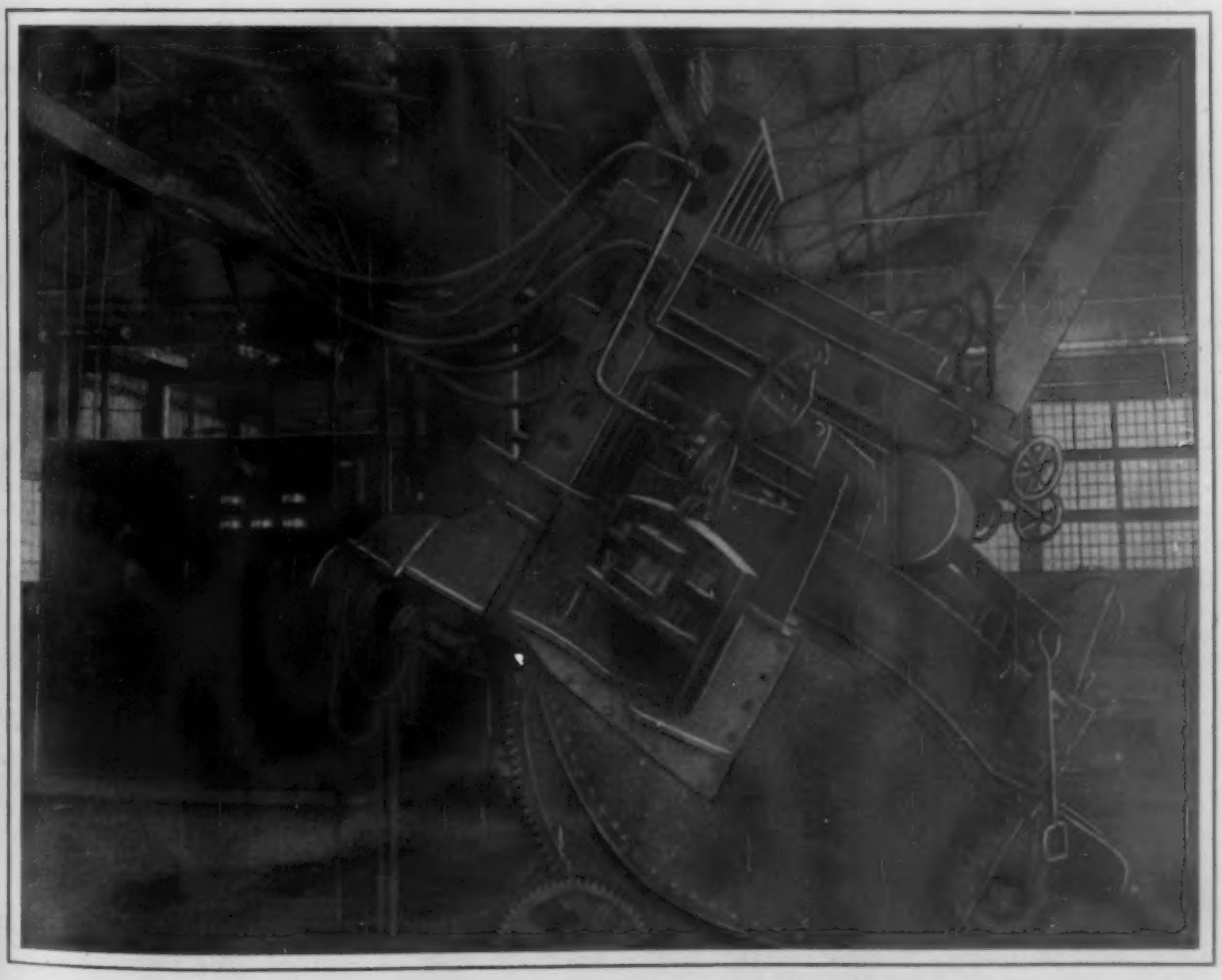


Fig. 1—Electric Furnace in Steel Foundry of Treadwell Engineering Company

Fig. 2—Portion of Steel Foundry Showing Furnace

Through the roof, which is removable, pass three electrodes, which are water cooled. The electric power is purchased and is received at 11,000 volts. The current is stepped down to about 85 to 90 volts and is three-phase at 60 cycles, and 2500 amperes are used. The furnace is of the tilting type and three small motors are used to raise and lower the electrodes, this being done automatically. The switchboard has a voltmeter, a wattmeter and three ammeters. The lining is basic, with the usual basic bottom. The roof is of silica brick and a spare one is always on hand, as it has to be replaced more often than the lining of the furnace proper. The current is introduced by means of the electrodes, which come to within ½ in. of the top of the slag after the charge is melted, and are kept at about the same distance from the cold charge as it is melting.

Operation

The charge consists of heads and gates from previous heats and of small scrap purchased in the open market. No pig iron is charged. The capacity of the furnace is two tons and four heats can be made in 24 hr. Two or three hours are necessary to melt the charge and one to two hours to refine it. The first part of the process is practically the same as in a basic furnace. After the elimination of the usual elements the oxidation slag is removed by tilting the furnace. The desulphurizing slag is then introduced by adding coke, lime, fluorspar and ferrosilicon. Upon the completion of the refining the usual additions of ferrosilicon and ferromanganese are made and the steel tapped after turning off the current and tilting the furnace 45 deg. The large castings are poured directly from the ladle, but the smaller ones from crucibles into which the metal is run from the ladle. By this method the total time of pouring is cut down and there is less loss from skulls or from waste.

Practically all small Heroult furnaces have but two electrodes and it has been contended by some authorities that it is impracticable to operate a small furnace of this type with more than two electrodes. Yet here is one successfully running every day with three electrodes on a three-phase current. The electrodes are 8 ft. long at the start, but only 4 ft. is available for consumption, the remaining 4 ft. being necessarily thrown away.

Quality of the Metal

A great many tests, both chemical and physical, have been made of the product of this furnace. The aim of the company is to produce a low carbon ductile metal of uniform composition, low in phosphorus and sulphur, and having a tensile strength of not less than 60,000 lb. per sq. in. as poured or unannealed. Such a metal meets all the requirements of the average specifications for mild steel. At the same time it will compare and compete with any metal that other producers of small castings by any other established process can produce. A few analyses made by a consulting laboratory and taken at random from the company's records are given in Table 1.

Table 1—Analyses of Electric Furnace Steel

Carbon, per cent.	Manganese, per cent.	Silicon, per cent.	Sulphur, per cent.	Phosphorus, per cent.
0.17	0.56	0.36	0.021	0.024
0.19	0.43	0.29	0.015	0.023
0.14	0.52	0.29	0.018	0.026
0.21	0.66	0.29	0.012	0.017
0.13	0.51	0.29	0.020	0.023
0.12	0.67	0.31	0.015	0.036
0.23	0.45	0.23	0.013	0.023
0.29	0.49	0.37	0.025	0.022

From these analyses it will be seen that it is possible to produce a low-carbon metal of low-phosphorus and especially of low-sulphur content. These latter elements can be reduced still further if desired, as the refining process is capable of being carried to almost any extent, but this is not found to be necessary, a metal of 0.020 per cent. sulphur and phosphorus meeting all demands. It is the common belief among foundrymen that high sulphur causes steel castings to check. However this may be, it is a fact that castings from the electric furnace are peculiarly free from these defects.

A high carbon metal can also be successfully produced as evidenced by the analyses here given:

Carbon, per cent.	Manganese, per cent.	Silicon, per cent.	Sulphur, per cent.	Phosphorus, per cent.
0.46	0.62	0.51	0.012	0.026
0.48	0.58	0.64	0.011	0.029
0.47	0.57	0.48	0.015	0.023

Uniformity of Composition

In order to determine whether the various heats were uniform as to composition, analyses were taken from the first and last parts of some of the heats. A typical example of this is shown in the following:

	First part, per cent.	Last part, per cent.
Carbon	0.14	0.14
Manganese	0.49	0.53
Silicon	0.48	0.49
Sulphur	0.013	0.014
Phosphorus	0.022	0.023

There is a surprisingly uniform composition throughout. And this is one of the valuable characteristics of this process, besides ability to make a very pure metal, so far as sulphur and phosphorus are concerned. In addition, there is an absence of oxides and nitrides of any kind, rendering the steel as pure as can be made.

The physical properties of this metal are shown in Tables 2 and 3, the former containing the lists of the unannealed steel and the latter the annealed. These are all from the company's records and were made by the Henry Souther Engineering Company.

Table 2—Tests of Unannealed Steel.

Test	Tensile strength, lb.	Elastic limit, lb.	Elong. in 2-in. per cent.	Red. of area, per cent.	Fracture	Elastic ratio, per cent.	Carbon, per cent.
Low carbon:							
1	58,300	31,500	23.5	26.6	Irregular	54.01	0.11
2	65,200	44,400	20.5	25.8	"	68.08	0.11
3	65,800	44,900	29.5	51.0	"	66.71	0.18
4	64,800	33,700	25.0	34.2	"	52.00	0.23
High Carbon:							
5	102,740	66,480	3.0	4.9	Granular	64.70	0.46
6	93,900	61,000	4.0	2.5	"	64.95	....
7	85,000	45,000	12.0	18.0	"	52.00	....

Table 3—Tests of Annealed Steel

Test	Tensile strength, lb.	Elastic limit, lb.	Elong. in 2-in. per cent.	Red. of area, per cent.	Fracture	Elastic ratio, per cent.	Carbon, per cent.
Low carbon, quick cooling:							
8	63,500	46,000	29.5	37.0	Angular	72.44	....
9	66,100	49,500	25.0	33.5	"	74.88	....
10	69,900	59,700	29.0	47.4	"	85.40	0.13
11	71,200	46,900	22.5	38.3	Irregular	65.87	0.13
12	67,900	51,100	32.0	52.6	"	75.27	0.13
13	62,800	40,300	31.0	56.1	"	64.17	....
Low carbon, slow cooling:							
14	60,700	42,350	31.0	45.0	Silky	69.76	0.16
15	66,300	51,000	27.5	35.2	"	76.90	0.13
16	66,800	51,000	29.5	31.1	"	76.34	0.18
17	71,400	52,000	25.0	40.8	—	72.82	0.23
High carbon, quick cooling:							
18	112,100	72,800	17.0	22.7	Fine granular	64.05	0.48
19	104,270	72,860	18.0	27.1	Silky	68.91	0.46
20	111,800	76,100	21.0	33.7	Fine granular	68.06	....

In addition to the foregoing chemical and physical tests and in further corroboration of them, the writer had the privilege of examining two bars of this steel some months ago. The chemical analysis of these bars was:

	Carbon, per cent.	Manganese, per cent.	Silicon, per cent.	Sulphur, per cent.	Phosphorus, per cent.
Bar 1	0.13	0.58	0.373	0.019	0.015
Bar 2	0.13	0.57	0.359	0.021	0.015

These bars were subjected to the annealing process to which the general run of steel castings are put; i. e., heating slowly to about 1650 deg. F. and allowing them to cool gradually from this temperature after proper soaking. The physical results from these two bars were as follows:

	Tensile strength, lb	Elastic limit, lb.	Elongation in 2 in., per cent.	Reduction of area, per cent.	Fracture	Elastic ratio, per cent.
Bar 1	57,570	37,370	35.0	62.1	cup	61.0
Bar 2	59,800	40,200	32.5	59.8	cup	67.2

Some tests made within the last month are interesting and are as given in Table 4. The same high elastic ratio is maintained in both conditions and the same general uniformity.

Table 4—Comparison of Same Steel Unannealed and Annealed

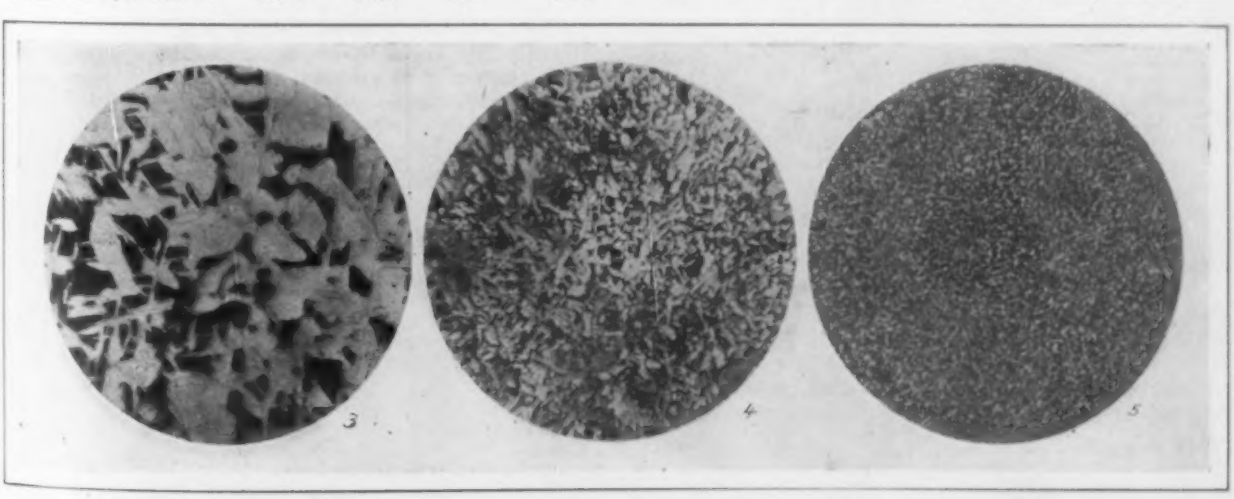
Unannealed:	No. 14	No. 20	No. 26	No. 31
Tensile strength, lb., per sq. in.	62,000	63,700	70,300	72,500
Elastic limit, lb., per sq. in.	37,500	34,400	47,100	42,500
Elongation in 2 in., per cent.	23.0	22.5	12.0	26.0
Reduction of area, per cent.	23.4	25.6	16.0	29.0
Elastic ratio, per cent.	60.48	54.00	67.0	58.62
Annealed:				
Tensile strength, lb., per sq. in.	64,300	74,600	75,300	80,900
Elastic limit, lb., per sq. in.	50,000	54,000	53,000	59,700
Elongation in 2 in. per cent.	34.5	23.5	30.0	19.5
Reduction of area, per cent.	54.7	20.6	37.8	20.2
Elastic ratio, per cent.	77.76	72.38	70.38	73.79
Analysis:				
Carbon, per cent.	0.14	0.17	0.29	0.29
Manganese, per cent.	0.52	0.56	0.49	0.59
Silicon, per cent.	0.29	0.36	0.37	0.47
Sulphur, per cent.	0.018	0.021	0.025	0.018
Phosphorus, per cent.	0.020	0.024	0.022	0.021

These are the results that might be expected from low carbon steel thus annealed. A different heat treatment, such as air cooling would, of course, have increased the strength. But the striking feature, as compared with any other kind of steel casting, is the high elastic ratio, running from 61 to 67 per cent. The average elastic ratio of open-hearth or other steel castings, similarly heat treated, is only 50 to 52 per cent. Examined under the microscope these specimens showed practically no oxides or slag present. Illustrating the typical metallographic characteristics of the product of this furnace, Figs. 3, 4 and 5, represent the structure of some of its recent output. Fig. 3 is a 0.23 per cent. carbon steel unannealed, and Fig. 4 is the same steel annealed, evidently by quick cooling. Fig. 5 is a 0.48 carbon steel after quick cooling. None, in the unetched condition, showed any traces of sulphides, oxides or slag, and as here reproduced they exhibit a uniformity that is in favorable contrast with much of the steel usually entering into steel castings.

At first glance none of these numerous tests strikes one as being anything extraordinary, especially as regards elongation. If they are carefully scrutinized, however, it will be seen that they possess an unusually high elastic ratio, seldom under 62 per cent. and usually much higher. This, of course, will account for the lessened elongation, for a high elastic limit is always secured at a sacrifice of elongation. However, this is an advantage, because the higher the elastic ratio the better the steel. It will also be noticed that in the green steel the tensile strength is unusually high for the carbon content—higher than in any other steel castings of similar composition. It is a fact, however, that no other process for making steel for castings produces a carbon metal having such a high elastic ratio, green or annealed. It is also rather singular that, except in the high carbon metal, annealing does not materially increase the elongation, but does decidedly augment the elastic ratio.

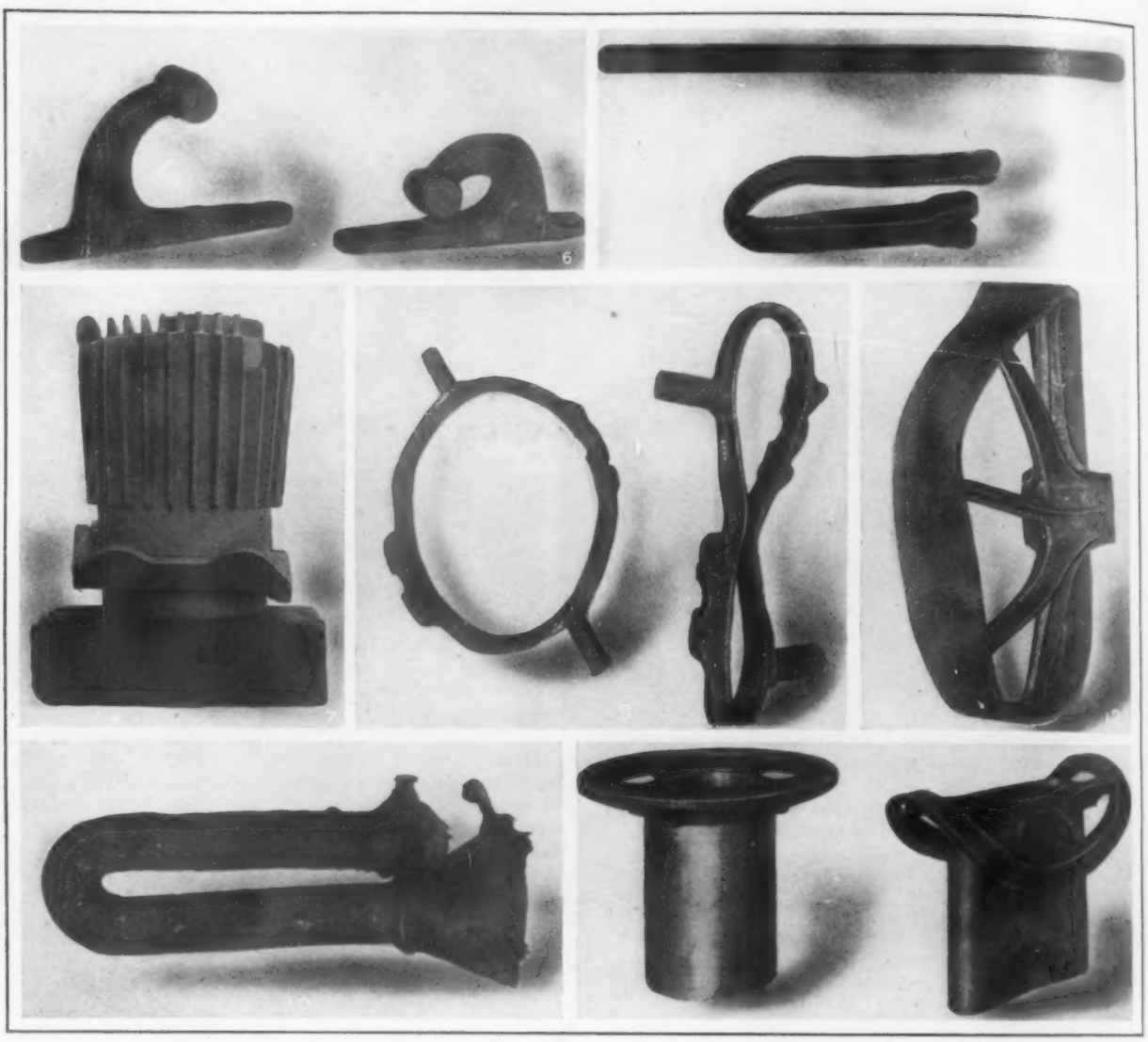
Effect of Alloys

The addition of vanadium, nickel, etc., to open-hearth or other steels will raise the elastic ratio and by this means



PHOTOMICROGRAPHS OF ELECTRIC FURNACE STEEL CASTINGS REDUCED ABOUT TWO-THIRDS ORIGINAL SIZE TAKEN AT 100 DIAMETERS, ETCHED IN NITRIC ACID.

	No. 3	No. 4	No. 5
Annealed	No	Yes	Yes
Carbon, per cent.	0.23	0.23	0.48
Tensile strength lb. per square inch	64,800	71,400	104,270
Elastic limit, lb. per square inch	33,700	52,000	72,860
Elongation in 2-inch, per cent.	25.0	25.0	18.0
Reduction of area, per cent.	34.2	40.8	27.1
Elastic ratio, per cent.	52.0	72.82	68.91



ELECTRIC FURNACE STEEL CASTINGS AND SOME DISTORTIONS.

No. 6, A Spring Hanger; No. 7, An Air-cooled Cylinder for a Flying Machine; No. 8, a Connecting Rod; No. 9, a Motor Support for an Electric Automobile; No. 10, a Gate Bent Cold; No. 11, a Hub Socket; No. 12, a Wheel Deflected 8 in. by Blows

physical tests of steel castings have been secured by the writer somewhat approaching the figures from the electric furnace steel with no alloys. For example, the average of 400 tests of annealed vanadium steel cast engine frames was as follows:

Tensile strength, lb., per sq. in.	78,014
Elastic limit, lb. per sq. in.	46,482
Elongation in 2 in., per cent.	22.96
Reduction of area, per cent.	35.89
Elastic ratio, per cent.	60.03

Just what would be the effect of the addition of alloys upon the product of this electric furnace is hard to say. The Treadwell Engineering Company has not tried such alloys, claiming that its steel is as good without alloys as that from other processes with alloys, or better.

In view of the fact that there is a growing demand from some sources for high-carbon steel, familiarly known as 0.40 per cent. carbon, special attention should be drawn to the achievements of this furnace in this respect. The average of the physical results of the quickly annealed high-carbon steel given in the tables is:

Tensile strength, lb., per sq. in.	109,390
Elastic limit, lb., per sq. in.	73,920
Elongation in 2 in., per cent.	18.70
Reduction of area, per cent.	27.80
Elastic ratio, per cent.	67.66

Slow annealing would give equally good proportionate results, and these would meet any existing specifications for such steel by a large margin. The tests here referred to were made in order to meet the specifications of the United States Government for gun carriages, calling for a minimum tensile strength and elastic limit of 85,000 lb. and 45,000 lb. per sq. in., respectively, with 12 per cent. elongation in 2 in. and 18 per cent. reduction of area.

It would be interesting to know just how this metal would behave if subjected to a long series of dynamic tests. Unfortunately, this information is not available because such tests have not been made. To many the real test of a steel is its ability to stand fatigue tests. The only data on this subject available are a few tests made by the Henry Souther Engineering Company, which reported as follows:

"We tested but three of the specimens sent us. These were so long-lived that we ran them for a much longer period than we anticipated, and as the results showed up so well, we did not think it advisable or necessary to run other specimens." One of these test pieces showed the following results:

No. 1 end Revolutions	Load	Fiber stress per sq. in.	Deflection	No. 2 end Revolutions
12,557,500	80 lb.	28,700 lb.	0.03 in.	12,557,500
6,211,700	110 lb.	38,870 lb.	0.05 in.	10,001,600
(Broke)	140 lb.	49,470 lb.	0.07 in.	3,019,700 (Broke)

Density of the Metal

In addition to the purity of this steel as regards sulphur, phosphorus, nitrogen and oxygen, mention should be made of its greater density, which goes far to explain its superior elastic ratio, permitting extremely violent shocks without permanently deforming or cracking the metal. A high authority on electric furnace steel has lately said: "Recent experiments in the United States demonstrate that steel made in the electric furnace has a greater density, and within the range of 0.08 to 0.75 per cent. carbon shows 10 per cent. greater strength than open-hearth steel of the same chemical composition." It has also been determined that the average weight of a very large number of small castings made from the electric furnace compared with an equal number from another process show an increase of

10 per cent. in favor of the former steel, but this is doubtful.

The product of the Treadwell foundry is principally automobile castings. It is the intention soon to specialize in automobile wheels. The company is making its own steel cylinders for hot metal cars, weighing 2500 lb. each, free from cracks and sand spots. Illustrating the castings produced by this furnace various photographs are reproduced, many of them showing by distortion under blows the extreme pliability of the metal in the unannealed state. Fig. 6 shows a spring hanger, such as is ordinarily used on automobiles; Fig. 7, an air-cooled cylinder for a flying machine, 4 to 5 in. outside diameter, 6 to 7 in. high, about ⅜ in. thick in the rough, with ribs ⅛ in. thick; Fig. 8, a connecting rod, I-beam section, about 2½ in. high with 2½ in. flanges; Fig. 9, a motor support for an electric automobile, average thickness about ⅜ in.; Fig. 10, a gate just as it was removed from a casting, but bent cold to 180 deg.; Fig. 11, a hub socket, about 4 in. outside and 3 in. inside diameter, 5 or 6 in. high and about 5/16 in. thick. Fig. 12 shows a steel wheel deflected 8 in. by blows. It should be stated that all these castings were distorted while in the green or unannealed condition. The writer saw some of these distortions made.

There is a large demand in this country for castings of this character and it is growing very fast, due to the rapid development of the automobile, the aeroplane and other machines calling for strong steels of small sections capable of standing repeated strains and shocks. The Treadwell Engineering Company is planning to double its electric melting capacity.

Universal Table for Floor Boring Machine

For use in connection with its floor type boring, milling, drilling and tapping machine, which was illustrated in *The Iron Age*, June 27, 1912, the Rochester Boring Machine Company, Rochester, N. Y., has brought out a universal table. A rotary movement of 360 deg. in the horizontal plane is provided, as well as a tilting movement of 90 deg., thus making it possible for various machining operations to be performed on all sides of the work and on the top, or at any angle without resetting. This construction, it is emphasized, results in a saving of time and more accurate work, since it is easier and quicker to change the cutters or tools than to reset the work in several different machines. Fig. 1 is a view of the table in its customary position, while in Fig. 2 the table is shown turned at an angle of 90 deg. in the horizontal plane, and also tilted.

The table is of the box type construction, braced and reinforced by cross ribbing to insure rigidity. It can be completely rotated in the horizontal plane by a worm which runs in an oil bath and meshes with a large diameter worm gear, having coarse pitch and a wide face. Graduations are provided which can be seen under the front of the table in Fig. 1 to facilitate setting. These graduations read to 1 deg. and with a micrometer dial additional readings can be obtained to one-twelfth deg. An adjustable zero indicator is also provided.

In addition to the 90-deg. tilting movement, the table

Fig. 1—The New Universal Table for the Rochester Floor Type Boring, Milling, Drilling and Tapping Machine

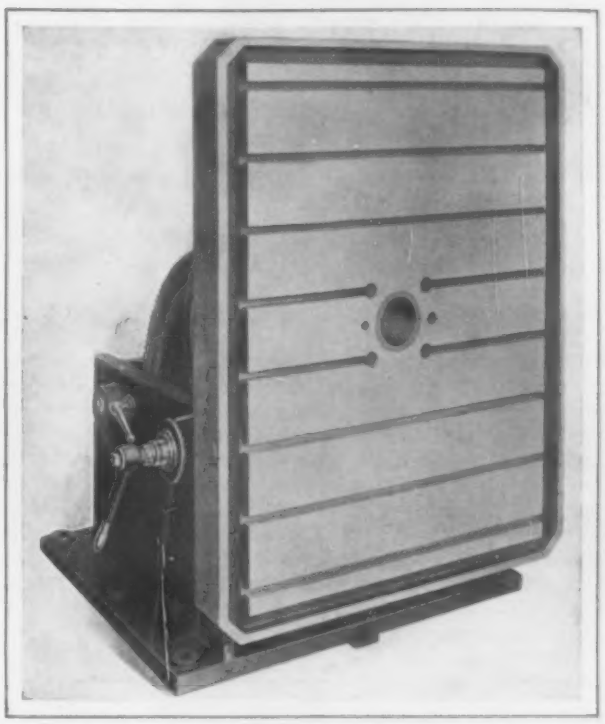


Fig. 2—The Table Turned at an Angle of 90 Deg. in the Horizontal Plane from the Position Shown in Fig. 1 and Tilted Vertically

can be traversed to and from the column by a ratchet which operates a pinion that engages a rack in the floor plate. This pinion and ratchet are shown in the lower portion of Fig. 1. When the table is being traversed it is guided by a tongue which engages a groove in the floor plate, thus insuring a movement parallel with the spindle. Elevating the table is accomplished by a worm, meshing with a worm wheel connected to a pinion which is cut solid on the shaft. This pinion meshes with the circular rack, which is shown at the left, in the rear of Fig. 2. One turn of the rotating crank gives a movement of 10 deg., while the rate of tilting is 1 deg. for each turn of the crank. The table can be clamped firmly in any position, either tilting, rotating or at any angle. A hole 4½ in. in diameter with a bushing is arranged in the center of the table, as shown, to permit boring bars to pass through. There is a locking device for clamping the bushings and the hole is provided with an oil pocket.

The following list gives the principal dimensions and specifications of the table:

Width, in.	38
Length, in.	50
Hight from floor, in.	31¼
Thickness, in.	5
Number of T slots	8
Size of T slots, in.	¼
Approximate net weight, complete, lb	4,200

The Production of Fluorspar in 1912

The quantity of flourspar mined in the United States in 1912 was 117,282 net tons, compared with 93,563 tons in 1911, according to an advance statement by E. F. Burchard, of the United States Geological Survey. The production and sales in 1912 were by far the greatest ever recorded. The average price per ton for the whole country, on board cars or barges at railroad or water shipping points, considering all grades of fluorspar (gravel, lump and ground) was approximately $6.60 in 1912, as compared with $7.02 in 1911—a decrease of 42 c. a ton.

Fluorspar was produced in 1912 in Illinois, Kentucky, Colorado, New Hampshire and New Mexico, ranking in the order named. Increases in sales were reported in Illinois and Colorado, while Kentucky, New Hampshire and New Mexico reported slight decreases. The quantity marketed in 1912 in the Illinois-Kentucky district was 114,410 tons, valued at $756,653. Of this total 97,150 tons were of gravel spar, valued at $565,784; 5315 tons lump spar, valued at $36,553, and 11,945 tons ground spar, valued at $154,316. The output of Colorado, New Hampshire and New Mexico was 2135 tons of gravel spar, valued at $12,510.

A New Hydraulic Transmission Gear

Speed Variation and Reversibility Two Features of a Compact Simple Device, Which Is Applicable to a Wide Variety of Uses

The Waterbury Tool Company, Waterbury, Conn., has brought out a hydraulic power transmission gear, which has been tested out for two years on men-of-war for elevating guns and controlling turrets. Apart from this field these gears are applicable to automobiles, cars, drawbridges, cranes, hoists, machine tools and the propelling of vessels. The particular features about the gear are a compact arrangement, the use of a somewhat novel method for automatically preventing leakage between the parts of the device, the lubrication of the various parts, the absence of any transmission of side pressure and the use of a special design of roller bearing and universal joint connections. Fig. 1 is an exterior view of the gear, while in Fig. 2 the outer casing has been removed and the internal parts are slightly separated to show their arrangement. In Fig. 3 sectional plan and elevation views of the gear are given.

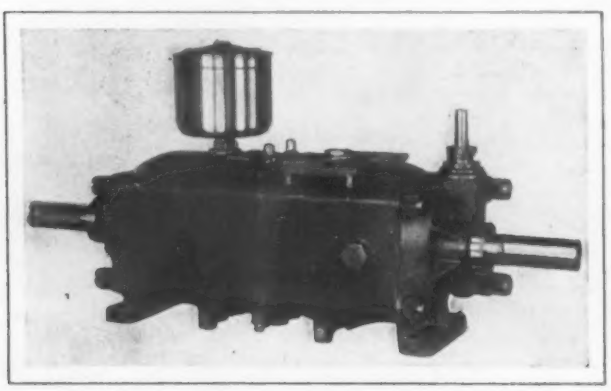


Fig. 1—Exterior View of the New Waterbury Hydraulic Speed Gear

The complete transmission device is made up essentially of two parts, an oil pump designated as the A-end, which may be driven by any source of power, and is supposed to run at a constant speed in one direction, and an oil engine designated as the B-end. By the turning of a small control shaft connected with the A-end, the stroke of the pump pistons is varied at will to deliver oil to the B-end at a rate necessary to give the required speed in the direction called for. The B-end is constructed to furnish a constant cylinder capacity per shaft rotation and the speed of the B-shaft is definitely determined by the rate at which oil is supplied by the pump. The speed ratios between the two shafts are positively and definitely determined by the angular position of the control shaft in either direction with reference to its neutral position.

In Fig. 1 an external view of the gear in its most compact or type C form is given. In this type the two ends are combined into one working unit, the power entering by the A-shaft at the right, which rotates at a constant speed, and is taken out by the B-shaft at the opposite end, which rotates at any required speed and in either direction. The small vertical shaft shown in the engraving at the A-end is the control shaft, and the direction of rotation of the B-shaft is determined by the direction the control shaft is rotated from its zero position, and the speed of rotation is determined by the angle through which the control shaft has been turned. On top of the B-end is an oil expansion box communicating with the oil in the machine. The whole inclosing shell of the gear is filled with oil, although only a small portion of the oil is under pressure and active in transmitting power. In this type of gear the two ends are united by a valve plate, which is located across the middle of the machine and through which the oil is circulated between the two ends. This valve plate can be made in almost any shape, permitting the placing of the two ends at any angle or in any position with reference to each other. Each end can be provided with a separate valve plate, located in any desired position, the oil circulation being provided for by connecting pipes.

In Fig. 2, which is taken in the opposite direction, the outer cases are removed, leaving the internal parts, the two groups being separated slightly from the valve plate and the angle and tilting boxes being pulled away from the socket rings. The valve plate stands in the middle of the figure and passing through it about half-way between its center and periphery are two semi-annular passages for the circulation of oil between the two cylinders. When the gear is transmitting power one of these passages is under pressure, while the other is in suction, the functions being changed according to the direction of rotation of the driven shaft.

There are three pairs of valves connected with the passages. At the top are two small needle air valves used only for the escape of air from the passages and cylinders while they are being filled with oil. At the bottom there are two ball check valves used for replenishing any leakage that may take place from the high-pressure oil to the low pressure, and at the bottom, near the replenishing valves are two safety valves to provide relief if the gear should become overloaded. There is also a plugged hole connected with each passage near the top for attaching gauges to measure the oil pressure or the load carried. Near the top of the valve plate, and also in connection with all the valves, are holes passing through the plate, giving free circulation of oil between the two ends of the gear, together with bolt holes for securing the cases, and in the center of the plate are roller bearings for the inner ends of the shaft.

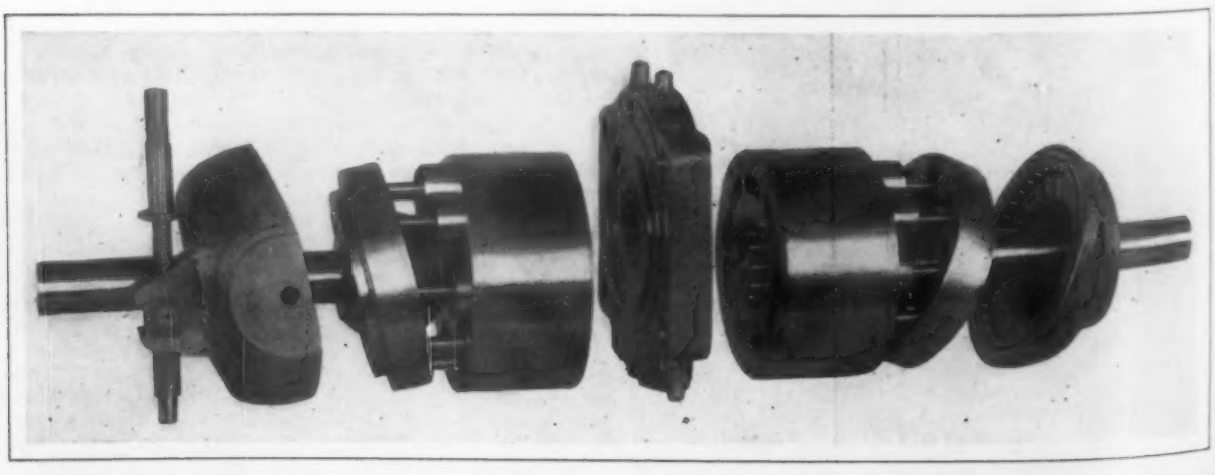


Fig. 2—View of the Gear with the Outer Casing Removed and the Internal Parts Slightly Separated to Show Their Arrangement

The shaft groups of parts in the two ends are almost identical, the arrangement being brought out in Fig. 3. A cylinder barrel, *a*, is keyed rather freely to the inner end of each shaft and is able to slide. Each of these barrels has nine cylinders parallel with the shaft and fitted with piston *b* having ball-ended connecting rods *c*. The faces

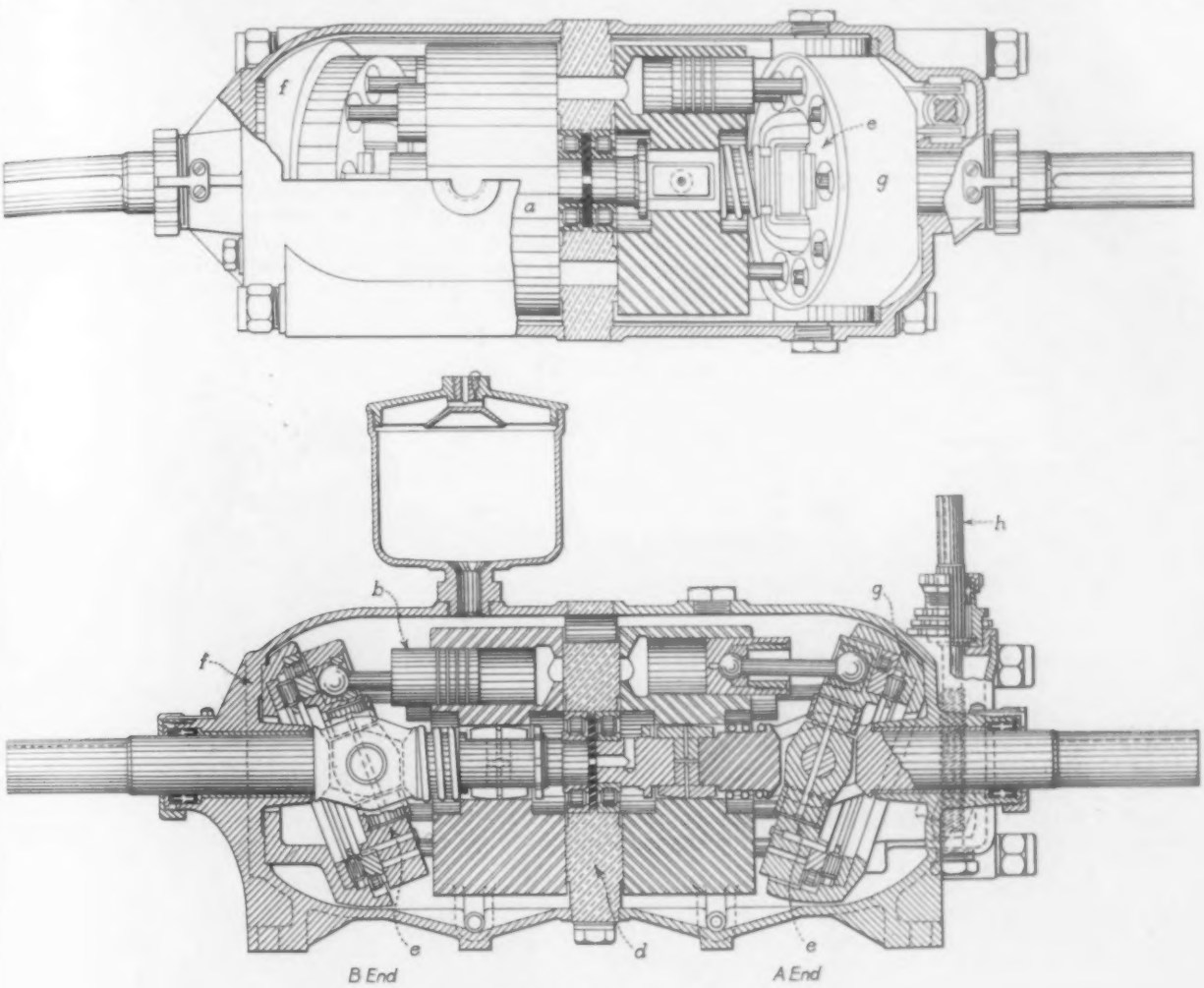


Fig. 3—Sectional Plan and Elevation Views of the Gear

of the barrels slide in their revolution against prepared faces on the valve plate *d* and the cylinder ports in the barrel faces register with the semi-annular passages except as they are passing over the separating lands at the top and bottom of the plate.

The barrels are held lightly against the faces of the valve plate by spiral springs around the shaft, which are compressed between shoulders on the shaft and counterbored recesses in the barrels. These springs are intended only to hold the barrels in position under no load, and when the gear is transmitting power the barrels automatically support themselves. The connecting rods are formed with a ball on each end, one ball end being secured in a piston and the other in a socket in the socket rings *e*, these rings being connected by special universal joints with the shaft. In this way, while the rings revolve with the shaft their planes of revolution may be at any angle to the shafts, the angularity being controlled by the setting of the roller bearings on which the socket rings revolve.

In the B-end of the gear the socket ring *e* runs in what is called an angle box, *f*, that is secured in the end of the case itself through which the shaft passes. It stands at a fixed angle of 20 deg., thus giving a constant reciprocation to the B-pistons. In the A-end the box is hung on trunnions and may be adjusted to any desired angle, while the gear is running by turning the threaded control shaft. The connection of the tilting box *g* with the control shaft *h* is clearly brought out in the drawing, and as the load on the trunnions of the box is practically a balanced one the turning of this shaft is easy.

The A-shaft which is connected with the source of power is supposed to run at a constant speed and in one direction. If the tilting box *g* stands in its vertical or neutral position at right angles to the shaft, the pistons are carried around with the cylinder barrel but do not reciprocate, and no oil, therefore, is taken from or delivered to the passages in the valve plate. If, however, by turning the control shaft *h* slightly the tilting box is inclined, the pistons reciprocate approximately to the extent of the sine of the angle of tilting multiplied by the diameter of the circle of centers of the sockets in the socket ring.

Every cylinder during one-half of the shaft rotation is in connection with one of the passages in the valve plate and is then receiving oil, which it carries across the land and delivers into the other passage during the other half of the shaft rotation, the amount of oil thus transferred depending entirely upon the piston displacement. There can be no transfer unless there is a supply to draw from and a space to deliver it into, and these are provided by the cylinders of the B-end. When oil is being forced into one of the passages which is already filled the pistons in the cylinders of the B-barrel in communication with this passage make room for the oil by sliding back from the valve plate, but they cannot do this without forcing their respective sockets in the socket ring farther from the valve plate. This can only be done by turning the socket ring as a whole in its inclined plane in the angle box.

It should be remembered that the B-socket ring, unlike the A, is always inclined at 20 deg. in its angle box, so that the B-pistons always reciprocate to their full extent at every rotation of the B-shaft, while the pistons facing the high pressure passages of the valve plate are receding to make room for the incoming oil and so imparting rotation to the B-shaft, the pistons facing the low-pressure passage are moving toward the valve plate and delivering the oil from their cylinders through the low-pressure passage into the suction cylinders of the A-barrel. Since the receiving capacity of the B-cylinders is constant and the delivery capacity of the A-cylinders is varied at will

by turning the control shaft, the speed of the B-shaft is correspondingly changed. It will thus be seen that the only oil actively employed in transmitting power is that in the oil passages of the valve plate and cylinders.

The oil pressure in the cylinders and valve plate passages varies directly as the torque resistance which the B-shaft must overcome. The horsepower transmitted varies directly as the product of the oil pressure and the speed of rotation of the B-shaft. The normal working oil pressure ranges usually between 300 and 500 lb., but it may rise to from 1000 to 2000 lb. to overcome an unusual resistance, and in tests pressures as high as 4000 lb. per sq. in. have been reachced.

One of the principal advantages of this type of transmission is its flexibility. The B-shaft may be started under a dead load of any magnitude within the strength limit of the machine without any fear of overloading the motor or source of power, and the speed may then be gradually increased up to a maximum. As a result of this flexibility it is pointed out that the efficiency varies widely. Under the best conditions efficiencies ranging from 85 to 91 per cent. are common, while under average working conditions the efficiencies vary between 80 and 85 per cent. Under small loads and low speeds of the B-shaft the efficiencies vary from 80 per cent. as a maximum down to 50 per cent. or lower. At a zero speed the horsepower efficiency must, of course, be zero, while the torque efficiency remains at 95 per cent. In this way the horsepower efficiencies have a wide range from zero to 91 per cent., while the torque efficiency throughout the whole range remains between 90 and 96 per cent.

Record Cement Production in 1912

According to an advance statement by Ernest F. Burchard of the United States Geological Survey, the total quantity of Portland, natural, and puzzolan cements produced in the United States in 1912 was 83,351,191 barrels, valued at $67,461,513, compared with 79,547,958 barrels, valued at $66,705,136, in 1911. This represents an increase in quantity of 3,803,233 barrels, or 4.78 per cent., and in value of $756,377, or 1.13 per cent.

The distribution of the total production among the three main classes of cement in 1912 is as follows: Portland, 82,438,096 barrels, valued at $67,016,928; natural, 821,231 barrels, valued at $367,222; puzzolan, 91,864 barrels, valued at $77,363.

The average price per barrel of Portland cement in 1912 was a trifle less than 81.3c., compared with 84.4c. in 1911. This represents the value of cement in bulk at the mills, including labor and cost of packing, but not the value of the sacks or barrels. The average price per barrel for the country is about 13.9c. higher than the average price received for Portland cement in the Lehigh district, where it was sold at the cheapest rate, and is near the average price received in the Iowa-Missouri district, but it falls 54.5c. below the average price received on the Pacific coast, where Portland cement brought the highest figure during the year.

The apparent stock of Portland cement on hand at the end of 1912 amounted to 7,811,329 barrels, compared with 10,385,789 barrels on hand at the close of 1911, according to reports and revised estimates, thus indicating a reduction in stock of more than 2,500,000 barrels during 1912.

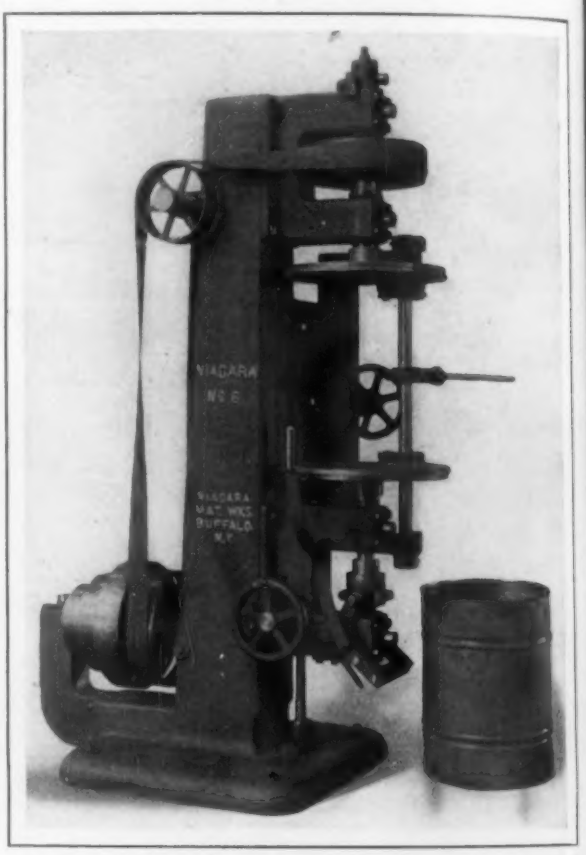
Trained nurses to teach foreigners the rules of health and sanitation, and how to work in conjunction with physicians in caring for the sick, will be provided by the H. C. Frick Coke Company at coal and coke plants in the Connellsville region. It is also the intention of the company to arrange small first-aid hospitals so that sick and injured workmen and their families may be given medical aid and expert attention, without cost to the patient. Physicians will be engaged to cover certain territory, which will be mapped out by the company's officials.

The Portsmouth Engine Company, Portsmouth, Ohio, has been awarded a contract through H. H. Hossman, the general contractor, for furnishing castings and machine work for new stoves and furnace repairs for the Bessie Ferrosilicon Company, New Straitsville, Ohio.

Double Seaming Machine for Cylindrical Work

A recent product of the Niagara Machine & Tool Works, 639 Northland avenue, Buffalo, N. Y., is a new double seaming machine for cylindrical packages. It doubles the output of ordinary machines which finish only one end at a time and is designed for comparatively large-diameter work, such as oil and asphalt barrels, ash and garbage cans, soda drums, etc. The maximum size of work handled is 26 in. in diameter and 36 in. high, the material being No. 24 gauge soft steel or lighter.

The machine is of massive and rigid construction, the frame being of cored box section. The upper spindle is mounted in a fixed position while the lower one can be adjusted vertically by a screw and handwheel to accommodate packages of different hights. The vertical chuck spindles have ball thrust bearings. Three different rates of speed are provided, so that the machine can run at a high rate on small diameters and more slowly on the larger



A Power Double Seaming Machine for the Making of Cylindrical Metal Packages

sizes. The seaming roll levers are mounted on a vertical shaft at the right and can be adjusted to suit the hight of the work. In operation the barrel to be seamed is clamped between the two chucks by the lever on the left side of the machine.

The two ends of a drum or barrel can be double seamed simultaneously or one end can be double seamed and laid over the top edge of the barrel at the same time. In doing this work the ends are turned over for a short distance at right angles and the heads are slightly recessed before the barrel is placed in the machine.

The Chapman Engineering Company, Mt. Vernon, Ohio, reports considerable activity in orders for gas producers. Among recent sales of its standard 10-ft. producers are six for the Forged Steel Wheel Company, Butler, Pa.; two for the Railway Steel Spring Company, Chicago Heights, Ill.; one for the Carnegie Steel Company, Mingo Junction, Ohio; two for the Nova Scotia Steel & Coal Company, Sydney Mines, Nova Scotia; six more for the Bethlehem Steel Company, South Bethlehem, Pa., which ordered six last year for open hearth work and gave them a thorough trial.

A Device for Speeding Up Twist Drills

For use in drilling machines of the larger size, where small holes are to be bored, the Graham Mfg. Company, Providence, R. I., has brought out a new line of high speed drilling attachments. They are intended for use in all drilling machines from the 20-in. size up to the largest machine of the radial type. The general advantage of the device is that it converts a slow running drilling machine into a high speed one, thus saving the cost as well as the space required for the extra machine. In connection with a radial drilling machine, the contrivance can be used for making the numerous small holes for oil, dowel pins, set screws, pins, etc., to advantage, an increase in speed of three times being secured. Fig. 1 shows a 21-in. upright drilling machine equipped with the device and Fig. 2 gives an idea of the arrangement of all the moving parts of the device.

The shank used by this device is of the regular taper type and at the bottom there is fastened a case-hardened gear which meshes with two pinions mounted on studs. A pair of large gears which in turn mesh with the spindle pinion on opposite sides are fastened to these two pinions. The spindle and pinion are made of one piece of hardened tool steel and at the bottom, the spindle is fitted to a chuck, or it can be extended and a hole made in it to take drills having taper shanks. It is emphasized that this duplex arrangement of the gears, shown in Fig. 2, reduces the side strains and there is no end thrust transmitted through the case. A ball bearing is placed on a wide shoulder at the bottom of the shank and beneath this bearing is the top of the spindle, so that there is nothing intervening between the pressure applied to the shank of the device from above and that delivered to the spindle, chuck and drill below, except the ball bearing.

With a view to securing perfect alignment, the lower end of the shank has been reduced in area, and the shank extends downward until it is almost even with the top of the chuck. This extension forms a long bearing inside the spindle and a further support is given to the spindle by a bushing on the outside, which is made to take up any end wear that may occur. The two studs upon which the intermediate gear clusters are mounted serve also to hold the case together. As the case must not revolve, a bar to prevent it from doing so extends to the column of the machine or some other rigid object or may be held in the hand.

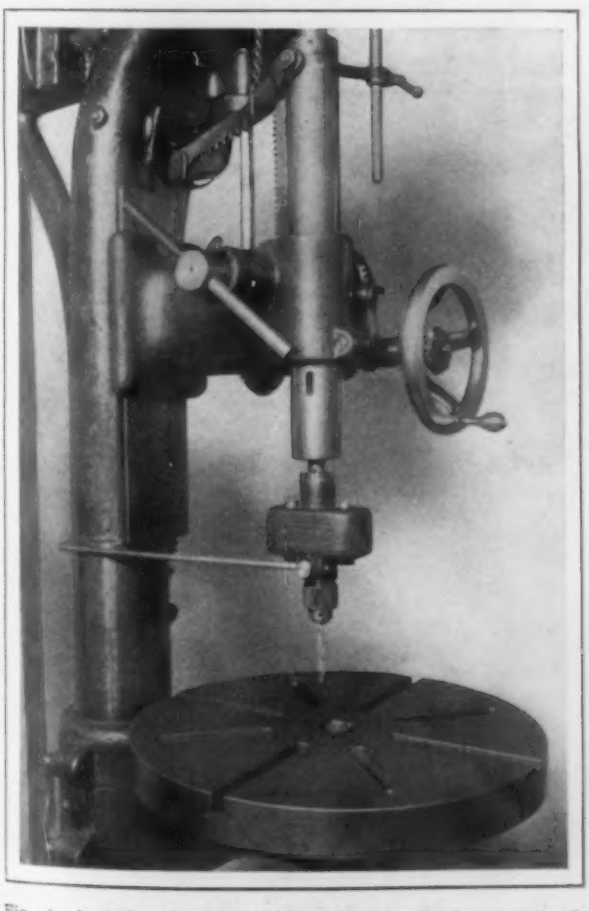


Fig. 1—A 21-In. Upright Drilling Machine Equipped with the Graham Twist Drill Speeding Device

In addition to this type of drill speeding device which is fed by the feed mechanism of the main machine, there is another type made with a sensitive feed lever. When this device is used, the main feed mechanism of the machine can be set and locked at any desired point, and the actual feeding of the drill is done by a mechanism contained within the device itself. This is intended for use on all classes of fine drilling, such as making holes to lines, making templates, jig holes, layouts, dies, dowel, oil, pin holes, etc. It is pointed out that the feed mechanism of the main machine is not ordinarily sufficiently sensitive to the touch and it is, therefore, necessary to provide a spring return feed lever on the speeding device itself. The driving mechanism in this style is the same as in the other types, the speed being increased three times. The spindle is driven by a bronze gear, broached to fit splines on its upper end. It extends upward into the shank for alignment and also to permit the necessary end movement. The spindle is mounted on a bronze rack sleeve into which a pinion meshes. This pinion is fastened to the return spring and the feed lever, and the vertical traverse of the spindle is secured in this way.

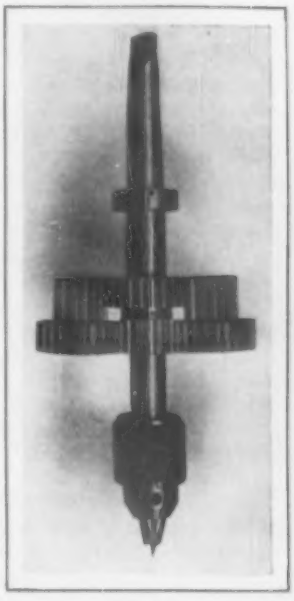


Fig. 2—View Showing the Arrangement of All the Moving Parts of the Device

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The International Oxygen Company, 115 Broadway, New York, will have a greatly improved exhibit at the Master Mechanics' and Master Car Builders' conventions, Atlantic City, N. J., in June. The generators to be shown are of the improved type I. O. C. generators, rated to produce 3.5 cu. ft. of oxygen and 7 cu. ft. of hydrogen per k.w.h., the purity exceeding 99 per cent. for the oxygen and close to 100 per cent. for the hydrogen. With this greatly increased efficiency there has been effected at the same time a reduction in the size of the generator of fully one-third, thus making a distinct gain, both in production efficiency and space. The company has installed numerous I. O. C. plants for welding and cutting. Among those purchasing such equipment are the General Electric Company, Erie, Pa.; John Wood Mfg. Company, Conshohocken, Pa.; Edison Storage Battery Company, Orange, N. J.; Westinghouse Lamp Company, Bloomfield, N. J.; United States Navy Yard, Brooklyn, N. Y., etc. The Midvale Steel Company, Philadelphia, Pa., is now installing one.

The Erie City Iron Works, Erie, Pa., is building a plant for W. B. Walker & Co. at Austin, Texas, to utilize a new process for making soap from cotton seed, using the oil and also a portion of the pulp. The installation will include a 17½ x 30 x 30 in. Lentz tandem compound engine, using superheated steam, supplied by two 165-hp. water tube boilers. The company has also received a contract from the Avaca Drainage District, Avaca Island, Morgan City, La., for a cross compound engine, equipped with a 72-in. centrifugal pump. The contract covers the complete installation, including pumps and condensers, the latter being furnished by the Alberger Company, New York City.

J. B. McCoole has been appointed receiver of the Troy Foundry Company, Troy, Ohio. The company's plant was damaged by the recent Ohio floods and this is given as the cause of its financial troubles.

New Steel Foundries Using Electric Furnaces

Supplanting Other Processes in the Chicago District—Interesting Data Concerning New Types and Costs

BY OLIVER J. ABELL

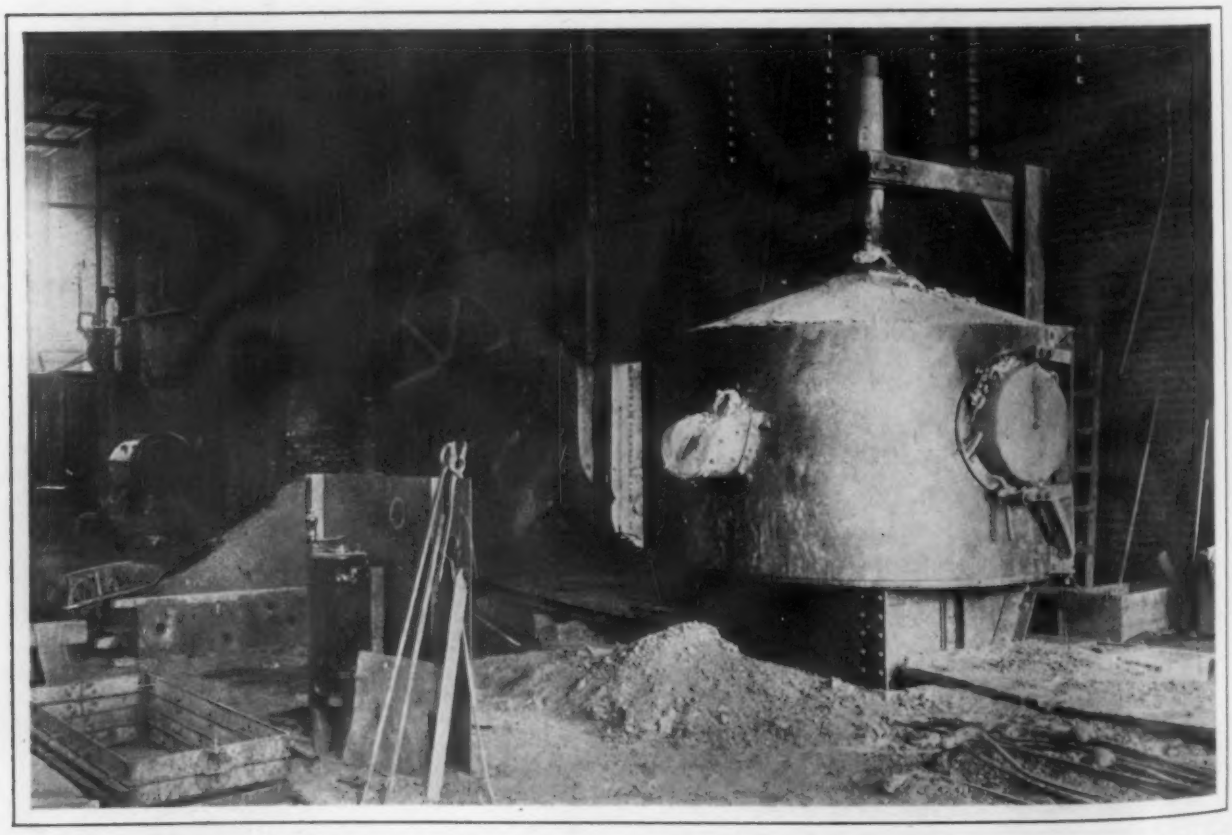
The development of the electric steel furnace as a commercial melting unit in a steel foundry has made very tangible progress in the Chicago district. At Buchanan, Mich., the Buchanan Electric Steel Company, with a Stassano type of furnace built under its own direction, has been making by contract castings of quality for over a year. The Chicago Electric Castings Company, at Chicago, recently organized, is now operating a foundry in which an electric furnace has been run successfully, though intermittently, for a similar period. The latest installation, completed but not yet operating regularly, has been made in the plant of the Crucible Steel Casting Company, of Milwaukee. The furnaces at the foundries in Chicago and Milwaukee are similar and are of a type particularly adaptable to foundry use, and designed by the Metallurgical Engineering Company, of Chicago.

Description of Furnace

The general design of this furnace is shown in the accompanying illustrations, which are views of the Chicago Electric Casting Company's installation. Except for the fact that it has an acid instead of basic bottom, the furnace at Milwaukee differs only in the shaping of the lower half of the shell which is tapered instead of cylindrical in order to reduce the radiating surface. As between the basic and acid linings there is no great choice under the conditions obtaining in the district. The former bottom involves a somewhat more difficult melting problem but makes possible the charging of a wider range of scrap and admits of refining reactions in the metal melted. In practice the question of a freer choice of scrap is of little importance in these plants as the basic furnace at the Chicago plant is run almost entirely on acid stock.

The furnaces have a rating of 10 tons for continuous melting through 24 hours, but this capacity is reduced when operating through a 10-hour period only and in small heats. The furnaces accommodate charges of 1 to 1½ tons and the duration of heat is such as to permit pouring every 3 hours. Where four heats are to be poured in a 10-hour shift the furnace is heated up in advance in the morning. One view shows the furnace in the erect position during the melting period and the other view shows the furnace tilted for pouring. The furnace proper is mounted on a rocker of built-up structural section. This rocker rides on two axles, the one a driving axle and the other an idler. These axles are hung in a subfloor excavation and the tilting action is accomplished by means of a motor-driven gearing and controller of the ordinary traveling crane type. The design of the furnace and tilting rocker is such that the center of rotation is at a point near the end of the pouring spout so that the hot metal discharges at a fixed point regardless of the angle at which the furnace is tilted, thus making it possible to pour directly into a small ladle. The electrode is supported by means of the horizontal arm shown in the illustration, this arm being raised and lowered by means of the handwheel and pinion operating on the vertical rack at one side of the furnace.

The recent announcement of the Standard Oil Company with reference to fuel oil and the subsequent advance in its price from 2.15 c. to 4 c. per gallon focused attention upon the electric furnace as a possible substitute for the crucible furnace. While the electric furnace was thus made a more attractive proposition the results obtained during the past year indicate that its melting cost could compete with that of the crucible furnace at the lower price of oil, on favorable terms, and compete also with the converter, where the cost of current did not exceed 1½ c. per kw-hr., which is the case generally in this section.



Electric Furnace Installed at the Plant of the Chicago Electric Castings Company. The Furnace is in the Vertical Position While the Charge is Being Melted. The Controller from Which the Tilting of the Furnace is Governed is Shown at the Left

Electric Furnace Tilted in Position to Pour, Showing Part of the Sub-structure for Tilting

Current Consumption and Cost

The performance of the furnace of the Chicago Electric Castings Company showed a current consumption varying from 900 kw-hr. to 700 kw-hr. per ton of hot metal in the ladle under favorable conditions. Under average conditions, pouring four heats a day, a consumption of 800 kw-hr., equivalent to a cost of from $10 to $12 per ton of hot metal, was developed. The cost of the charging metal was approximately the same per ton, the low cost of production being due in part to the very small loss in melting which does not exceed 5 per cent. in the electric furnace, melting a good grade of heavy scrap, as compared with approximately 25 per cent. in the converter. The cost of electrodes, maintenance and labor brings the total cost of hot metal from the electric furnace up to about $30 per ton, or approximately the same as the cost of hot metal from the converter and about half the cost of hot metal in the crucible foundry at the present price of oil, assuming the cost of crucibles to be from $2.30 to $2.35 each.

At the plant of the Crucible Steel Casting Company the electric furnace will supplant eight Milwaukee type 6-pot furnaces. These furnaces operating alternately in sets of four, with four pots of the six in each furnace melting steel, have a capacity averaging about three-quarters of a ton per heat with four heats taken off per day. The experience of the past year indicates that the success of the commercial operation of the electric steel foundry is not dependent upon securing premium prices for castings. Except where alloy steels or steel of exceptional density are produced, steels that command special prices, it is expected that the electric steel foundry will operate on a strictly competitive basis. As compared with converter steel its advantage is claimed to lie in the securing of a dead melt and a perfectly deoxidized steel. As compared with the crucible foundry, the electric furnace with its heavier and uniformly melted charge is better adapted to the pouring of large castings.

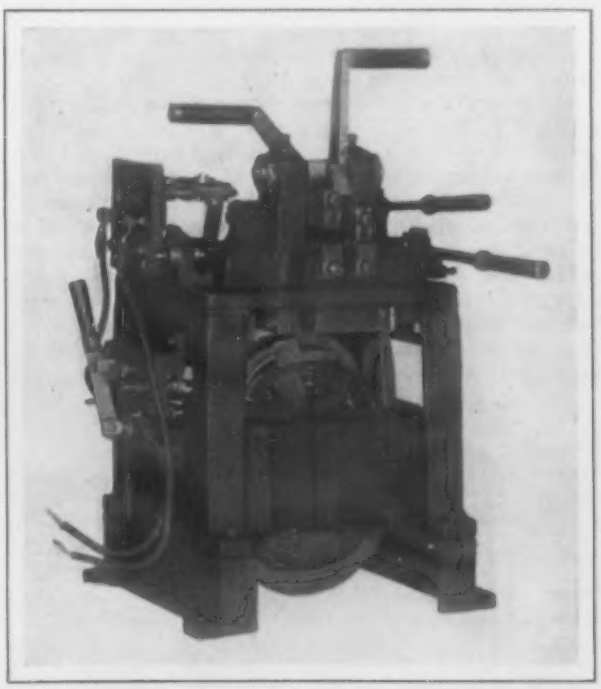
Economy in Floor Space

In the matter of maintenance the experience with the Chicago furnace has been that the furnace bottom burns down and requires relining about every two weeks. The roof burns out with about 150 heats. An economy of floor space is also possible with the electric furnace as compared with both the converter and crucible furnace, particularly the latter. In the case of the foundry at Milwaukee the eight crucible furnaces occupy the greater part of one side bay, or about a third of the foundry floor area, while the electric furnace is placed at one end of the central bay where the floor is not readily accessible for pouring at any time. The dismantling of the crucible furnaces in that case would recover to the foundry for pouring or molding purposes a substantial fraction of the entire floor space.

Bench Type Electric Butt Welding Machine

For butt welding small round and rectangular shapes in steel, brass and copper, ranging in diameter from ¼ down to 1/32 in., the National Electric Welder Company, Warren, Ohio, has brought out a new electric welding machine. It is a small, hand-operated, portable machine, designed for use on a workman's bench, or it can be mounted on a truck and moved around a shop to the point needed. The general construction is very similar to the larger machines of the company, and among the special features included in it are an automatic trip and a variable voltage regulating device for controlling the current for different sizes and kinds of material.

Among the uses to which the machine can be put are the welding of the ends of coils of wire for wire fencing and repairing by welding any breaks which may occur when the wire is being drawn. After the two broken ends are welded together, it is emphasized that the joined



A Portable Electric Welding Machine for Butt Welding Small Rectangular and Round Stock

section can go through the drawing die, which could not be done if the two parts are spliced together. The machine is designed to be operated on a 110-volt, 25-cycle alternating-current circuit, but it can be supplied for any standard voltage. The adaptability of this machine for such a low frequency current is somewhat unusual, it being stated that heretofore it was not generally considered practical to operate a welding machine on a 25-cycle current. The floor space occupied by the machine measures 12 x 15 in. and the hight is only 18 in.

A New Stockbridge 20-In. Shaper

A Back-Geared Machine with Double Bearing Crank and Improved Cross Feed

The Stockbridge Machine Company, Worcester, Mass., has brought out an improved type of heavy duty shaper, designed to meet requirements of an unusual amount of

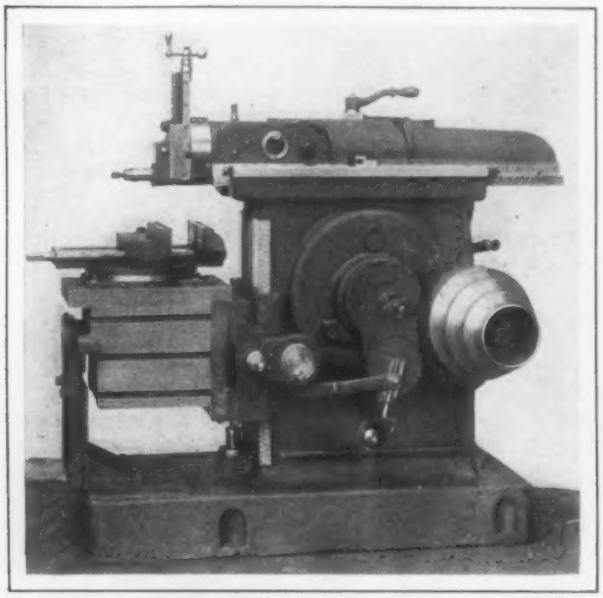


Fig. 1—The Stockbridge 20-In. Back Geared Shaper

power at the tool point. A number of new features are embodied in the machine, including a cross feed which makes it impossible to feed against the cut; the only operation necessary for changing the direction of the feed being to throw a handle from one position to another, which may be done without stopping the machine. The crank has a double bearing, eliminating all overhang and giving a rigid support and maintaining alignment, thus insuring smoothness of finish to the cut.

The mechanism of the cross feed is shown in Fig. 2. A reciprocating motion is imparted to *a* through the usual type of cross-feed rod. The click *b*, is in turn, moved over the internal ratchet gear *c*, giving it an intermittent motion, the amount of which is determined by the degree of feed, which is adjustable. This motion is communicated to the cross feed screw *h*, either directly through the intermediate gear *f*, or through the two intermediates, *f* and *g* for the reverse direction of feed. In order to secure these two positions in the train, the intermediate gears are supported on a rocker, which can be thrown to either of three positions, that shown with the handle at *d* giving

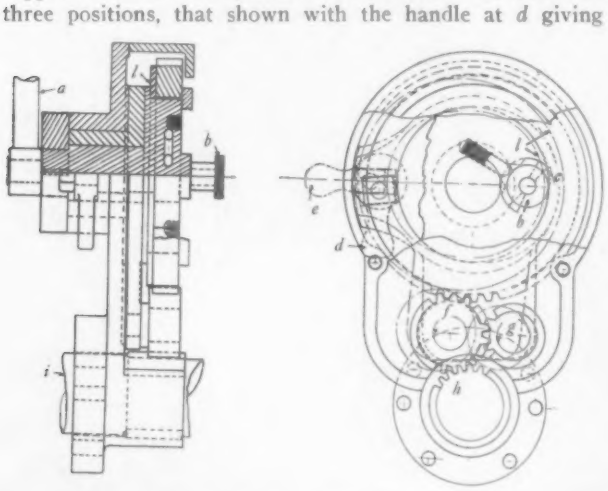


Fig. 2—Details of the New Cross Feed of the Stockbridge Shaper

a direct feed through the gear *f*. By moving the handle 180 deg. the feed is through the two intermediates. The third position *e* is neutral with the yoke *l* raised sufficiently to throw automatically the click *b* out of engagement with its gear. It will be seen that the possibility of gears catching when the feed is being changed is obviated. Also a saving of time is effected when it is desired to feed across and then back, for it becomes unnecessary to change the crossfeed rod or to employ the adjusting screw.

The driving cone is supported on an independent bearing built out from the shaper column, this bearing taking the entire belt pull. The driving shaft driven by a two-jaw clutch, *m*, Fig. 3, is carried in an independent bearing. The cone bearing *n* is bolted to the machine column and over it slips the bushing *o*, while within it fits the cone hub *p*. To this the cone *p* is fastened by four bolts *s*. The bearings are kept flooded with oil by means of the oil rings *t* operating in a deep oil well. All shaft bearings are bushed and are self-oiling.

The base is in keeping with the ample proportions of the rest of the machine. Its unusual depth provides sufficient metal to absorb vibration and to hold the weight put upon it without springing. It carries the knee and knee support with complete rigidity. The base is slightly concaved and has a pan cast in the inside, preventing the floor from becoming oil soaked.

The shaper is equipped with telescopic screw with ball thrust bearings for raising and lowering table. The top of the knee is made separate and hooks over the saddle, relieving the knee bolts of practically all strain. The ram can be positioned and adjusted to any length of stroke. Taper packings adjusted from either end by means of screws take up wear and assure alignment. The table support automatically adjusts itself to any hight of table and gives a bearing the entire width of table. The ma-

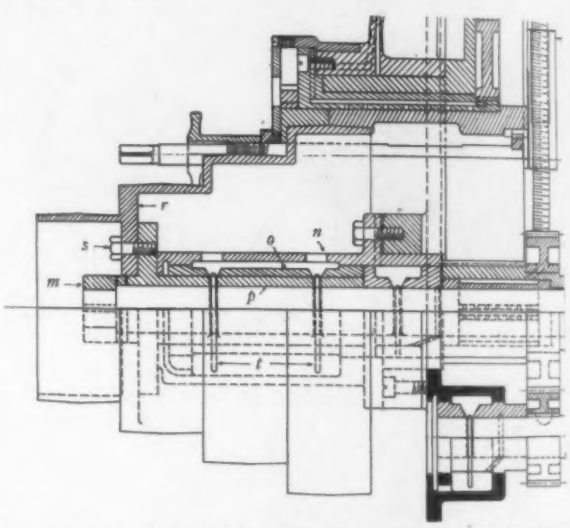


Fig. 3—Details of the Driving Mechanism of the Stockbridge Shaper

chine is equipped with the Stockbridge two-piece crank motion, which gives a 3 to 1 quick return.

Some of the principal dimensions are:

Actual length of stroke, in.	20¾
Vertical traverse of table, in.	13
Cross traverse of table, in.	26
Greatest distance ram to table, in.	15½
Diameter of head, in.	8⅝
Feed to head, in.	9
Top of table, in.	14 x 20
Side of table, in.	14 x 15
Vise opens, in.	13½
Vise jaws, in.	3 x 13½
Number of steps on cone.	4
Number of speeds to ram—cone drive.	8
Number of speeds to ram—gear box drive.	10
Speed of countershaft, r.p.m.	350
Total ratio of gearing—back gears.	26.4:1
Total ratio of gearing—direct drive.	6.6:1
Ratio of cutting and reverse strokes.	3:1
Net weight of machine and countershaft, lb.	3,750
Boxed weight of machine and countershaft, lb.	4,100

The Youngstown Foundry & Machine Company, Youngstown, Ohio, has just completed the erection of a new machine shop, 60 x 200 ft., of the most modern construction, and has moved all its machine tools from the former machine shop building to the new one, which is equipped with an electric 15-ton traveling crane. The company is now situated to better handle its rapidly increasing business. The old machine shop building will be used for a pattern storage. The company is also building an addition to its foundry 56 ft. long.

Puddlers and Rollers Ask for an Advance

The wage committee of the Amalgamated Association, in session at Fort Wayne, Ind., has recommended an advance of 50c. a ton for puddling and about 1 per cent. for finishing in mills that sign the Amalgamated scale for the year, commencing July 1. The present rate for boiling is $5.25 per ton on a 1c. card, and the wage committee increases this to $5.75. The new scale, which will be presented to the manufacturers for their signatures, is as follows:

Boiling per Ton of 2240 lbs.

Bar iron price	Boiling wages	Bar iron price	Boiling wages
1. c.	$5.75	1.55c.	$7.50
1.05c.	5.90	1.60c.	7.65
1.10c.	6.05	1.65c.	7.80
1.15c.	6.20	1.70c.	7.95
1.20c.	6.35	1.75c.	8.05
1.25c.	6.50	1.80c.	8.20
1.30c.	6.65	1.85c.	8.35
1.35c.	6.80	1.90c.	8.50
1.40c.	6.95	1.95c.	8.65
1.45c.	7.20	2. c.	8.80
1.50c.	7.35		

The wage committee also recommended the following rates on bushéling: On sand bottom—1c. bar iron, heavy scrap, $2.25; light scrap, $2.53. On cinder bottom—heavy scrap, $2.53; light scrap or turnings, $3.22; cast borings, $4.75. A slight advance is also asked on the muck bar scale.

A 15 per cent. increase is asked in base prices for mills making a specialty of working pipe or skelp from iron or steel. The same advance is asked in the scale for plate and tank mills, and also on guide, 10-in., hoop and cotton tie mills.

In the scale for sheet mills the committee recommends a 10 per cent. increase in the wages of shearmen, rougher, catcher, pair heater and doubler.

In the scales for tin plate mills, the committee recommends a 15 per cent. increase in wages for heaters, 10 per cent. for catchers and screw boys, 7 per cent. for roughers and 5 per cent. for doublers.

The Amalgamated Association has adopted all these suggestions. Material changes have also been made in the foot notes in nearly all the scales.

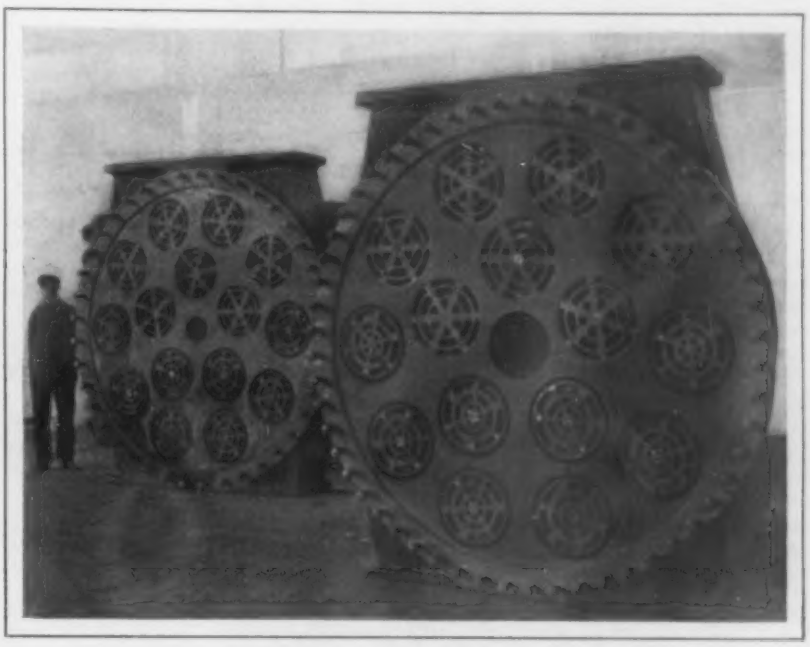
The Sons of Vulcan, in session at Pittsburgh last week, decided to demand a flat rate of $7 a ton for boiling for the year commencing July 1. The present scale of this organization, which expires June 30, calls for a flat rate of $6 per ton. While the Sons of Vulcan puddlers had the best of the situation for some months, starting from July 1, 1912, they have been working for a considerably less rate lately than the puddlers belonging to the Amalgamated Association, whose wages based on a sliding scale advanced steadily with advances in prices of iron bars.

It is intimated that some trouble may be experienced in arriving at a settlement of these scales this year. It is probable that a meeting between the Amalgamated Association and the Western Bar Iron Association will be held either in Detroit or Fort Wayne early in June. A conference between the Amalgamated Association and the Republic Iron & Steel Company will be held at a later date.

The United States Supreme Court on Monday, May 26, handed down a decision establishing the right of retailers to cut prices on patented articles sold by the manufacturers under price restrictions. Safety razors, talking machines, and thousands of other patented articles are affected. The court's decision was five to four, with Justices McKenna, Holmes, Lurton and Van Devanter dissenting. All decisions in the lower courts, with the exception of one, have been in favor of the manufacturers. The Department of Justice has contended that, once a patentee sells his patented article, he loses all control of it, and is powerless, especially in view of the Sherman anti-trust law, to establish resale prices.

A New Plate Type Blowing Engine Valve

After an exhaustive examination covering a period of three years the Mesta Machine Company, Pittsburgh, Pa., has brought out an improved type of air valve for blowing engines. The primary object in making the investigation was to secure the advantages which it was believed would follow by substituting the simple automatic plate valves which had been developed on the European Continent for the typical American blowing engine valves and valve gear. As the investigation proceeded it was found, however, that even these valves might be improved upon, particularly with reference to the method of guiding. In some of the valves slight extensions of the valve plate were employed, and in other pins or plugs fitting into the openings of the valve plates were used. The extensions on the first type of valve were subject to breakage, while the sliding between the valve and the pins caused friction and binding. At this time the idea of guiding the plate by a flat volute spring and to connect the spring to the plate by bending several prongs of the plate over and around the former, was conceived, and the Iversen valve, so called in honor of the inventor, was designed.



The Iversen Plate Type of Air Valve for Blowing Engines

Among the advantages claimed for this valve are long life, a decrease in resistance due to the absence of solid friction, and a large free valve area, the last due to the fact that no portion of the air current is obstructed by valve plate extensions. The method of guiding and fastening used is original and it is added has proved successful. No part of the plate is deflected during the regular operation of the valve and the volute spring, it is emphasized, can easily be so designed and can be made of such material as will endure deformation without fatigue, the correctness of this fact being borne out by the long life of valves in actual operation. The ones which have been in operation for the longest period of time are those installed in a large compressor in the works of the Mesta Machine Company, where they have been in day and night operation for two years. It is stated that the valves are apparently in as good condition as when they were first put in, and valves in blowing engines, while not in operation quite so long, have, nevertheless, been in service long enough to demonstrate the success of the valve.

The W. F. Robertson Steel & Iron Company, Cincinnati, Ohio, has purchased and removed to its factory the machinery and accessory tools of the entire rivet plant of J. A. Meeks, Muncie, Ind. This will give the Robertson Company a considerably increased output and also enlarge the range of the sizes it can make. Some of these machines make rivets 7/16 in. in diameter, and thus all the list sizes of miscellaneous rivets can be made up to 3 or 3½ in. long. The machines are now being set up and will be ready for operation in a short time.

Mechanical Engineers in Baltimore

The Meeting Last Week of the American Society — Cleaning Blast Furnace Gas

The 1913 spring meeting of the American Society of Mechanical Engineers, held last week in Baltimore, gave consideration to existing and proposed general patent laws, discussed briefly a code of ethics for engineers, learned of amendments to the constitution aiming at establishing a grade of membership higher than the average of the present grade of member and witnessed the conferring of honorary membership on Capt. Charles Henry Manning, chief engineer, U. S. N., retired. Only one paper was offered for discussion under the auspices of the gas power section of the society, that by Charles C. Sampson, gas engineer of the Illinois Steel Company, Joliet, Ill., and the one written discussion was presented by Capt. Frederick Henry Wagner, chief engineer of the Bartlett Hayward Company, Baltimore. While the attendance was fair, the proximity of the German meeting of the society (departure from New York to take place June 10) in connection with the Verein Deutscher Ingenieure undoubtedly reduced the number of participants and the simultaneous meeting in New York City of the American Iron and Steel Institute split the interest in the mechanical engineering problems of the steel industry. The entertainment features and the excursions to points of engineering interest were conspicuous.

A business and professional session was held on Wednesday morning, May 21, and professional sessions were held on Thursday and Friday mornings, the latter in the Capitol of Maryland at Annapolis to listen to a paper on the engineering experiment station at the Naval Academy by H. I. Cone, until lately in charge of the Bureau of Steam Engineering, U. S. N. On Wednesday afternoon there was a demonstration of the Baltimore high-pressure fire system and an inspection of the pumping station, followed by a trip around the harbor on a municipal steamer. On Wednesday evening a lecture illustrated by motion pictures entitled "Around the World in Eighty Minutes" was delivered by Hon. O. P. Austin, secretary of the National Geographic Society. On Thursday afternoon there was an inspection of the sewage pumping and purification plants and on Thursday evening a reception and dance was tendered by the Engineers' Club of Baltimore. Friday was spent in a visit to Annapolis and the United States Naval Academy, where a number of the society enjoyed flights in the hydro-aeroplanes of the Academy aviation fields.

Cleaning of Blast Furnace Gas

Mr. Simpson's paper on the "Present Operation of Gas Engines Using Blast Furnace Gas as Fuel" was printed in *The Iron Age* May 8, and what Capt. Wagner, whose engineering experience has included the design of coal and water gas plants, had to say was in part as follows:

From reports received, I find that with practically the same character of apparatus (first, dry dust cleaners; second, some sort of static towers like the Zschocke or Steinbardt; and finally, the Theisen washer) the final cleaning varies between 15 cents and 62 cents per 100,000 cu. ft. of blast furnace gas cleaned—this being based on $10 per 1,000,000 gal. of water and 1 cent per k.w.hr. The great discrepancy in these final figures has led to the question as to why such discrepancies should exist, but the answer is a difficult one to give. For instance, at one of the United States Steel Corporation plants, the final cleaning, based on 100,000 cu. ft. of gas, costs 61 cents; at another, 47 cents; at another, 42 cents; at another, 25 cents; at another, 20 cents; at another, 19 cents, and at another, 15 cents.

Mr. Sampson mentioned that some new apparatus, which is along the line of mechanical disintegrators, claimed to use about 20 gal. of water per 100,000 cu. ft. of gas for the whole cleaning process and to operate on less power than the Theisen washers. Mr. Sampson also stated that with the present process 90 to 100 gal. are used for the entire cleaning process.

At the last meeting of the Scottish Iron & Steel Institute, B. W. Head read a paper giving the results of his visit on the European Continent to examine blast furnace conditions. He mentioned especially the Feld vertical centrifugal washer for the cleaning of gas. Besides the Theisen washer mentioned by Mr. Sampson, there are two others, which are attracting a great deal of attention in Europe in connection with this process, namely, the Schwarz washer and the Feld washer mentioned before; these two washers both require less power than the Theisen washer, but the Feld requires considerably less power than the Schwarz.

At the blast furnaces in Donawitz, where 1,600,000 cu. ft. of blast furnace gas is treated per hour, the total power with the Schwarz washers amounted to 124 to 128 hp. At the blast furnaces in Pompey, France, of exactly the same capacity, the Feld washers used 50 to 55 hp., the power given including the necessary power for exhausters. Unfortunately in my data on the Schwarz washers, I have not the power of the washer and the exhausters separate; however, for the Feld washer, the washer power amounted to 15 to 20 hp. and for the exhausters 35 hp. This great difference in power requirements is due to the fact that the Feld washer sets up absolutely no back pressure, the washer operating with an even gauge on both the inlet and the outlet, while the Schwarz washer throws a considerable back pressure.

With a temperature of 500 deg. F. and treating 5,400,000 cu. ft. of gas per hour coming from two furnaces, reducing the temperature of the gas to 86 deg. requires about 31 gal. of water per 100,000 cu. ft. of gas. The cleaning of the gas after being cooled is done by the hot water from the cooling chambers. About one-quarter of the amount given above, or 7½ gal., is run into the washing chambers of the Feld washer; for this purpose the Feld washer is built in seven sections, the upper four acting as cooling chambers and the lower three as cleaning chambers. It is a known fact that if an impalpable powder be placed on a floor, and cold water is thrown on it, the water forms globules on the surface of the particles, but if hot water is thrown on the powder it immediately mixes and forms a mud. This is the principle on which the Feld washer is operated. Each one of the sections of this washer contains a series of perforated truncated cones, the lower ends of the cones dipping into the water, and by revolving the cones to a periphery speed of 1600 ft. per minute, the water is carried up inside these cones and hurled out the perforations in a finely divided spray.

In a lead smelting furnace, the Feld washers recover 6 tons of dust containing 80 to 100 per cent. lead every 24 hr. and entirely remove the lead particles, which formerly escaped into the atmosphere to the detriment of the surrounding vegetation.

In the blast furnace plant at Pompey, France, prior to the use of the Feld washers, it was necessary to open up the valve chests on the engines about once every 10 days and remove the accumulated dust; since the installation of the Feld system, it has only become necessary to open up the valve chests about once every three months. The washers have been in continuous operation for about 30 months without one moment's shut-down for cleaning or repairs—the washers being self-cleaning. The water carrying the dust leaves the washer in the shape of a mud, which is easily handled by means of centrifugal pumps.

A washer of the Feld type has just been placed in the works of the American Smelting & Refining Company at Maurer, N. J., for the purpose of removing the last traces of gold, silver, lead and silenium from the gas which comes from the mud cupel furnaces.

To clean 100,000 cu. ft. of blast furnace gas for gas engines purpose, or so that the final gas does not contain more than 0.01 gr. of dust per cu. ft., and to reduce the temperature from 500 deg. to 86 deg. F., would cost with the use of 9 Steinbardt coolers with the necessary Theisen washers, less labor and exhauster power, 14½ cents; with 9 Steinbardt coolers and Schwarz washers, 11 cents, and with three Feld primary and two Feld final washers, 5.2 cents. This is based on the cost of water at $10 per 1,000,000 gal. and power at 1 cent per kw-hr. in a plant capable of handling 5,400,000 cu. ft. of gas per hour.

Membership and Other Matters

In considering the report of the committee on a code of ethics, which was printed substantially in full in *The Iron Age* January 9, it developed that there were some differences of opinion over the need of the code, but it was finally voted as the sense of the meeting that the council of the society should give consideration to a resolution

offered by the committee providing for allowing the membership to vote by mail on each paragraph of the code and providing for the appointment of what is substantially a standing committee on the interpretation of the code.

Reports on recent mail voting of the society showed that accessions to membership and promotions in grade had been approved to the number of 605, about 90 per cent. of which represent an increase of new members. They also showed that the amendments to the constitution were passed providing for the council to elect members and for both associate and associate member grades. The new proposed amendments in this regard appear to be drawn to have a grade corresponding in requirements to those of some other national engineering societies. The requirement for member, for example, is, if the amendment should be subsequently passed, that the candidate must be at least 32 years of age and he must have had active practice of at least 10 years and responsible charge of work for 5 years and be competent to take charge as well as to design. The associate members must be not less than 27 years of age and have had 6 years' practice and been in responsible charge of work for at least 1 year.

Honorary membership was conferred on Capt. Manning by President W. F. M. Goss, as a distinguished engineer, a retired lieutenant-commander and chief engineer of the United States Navy, later identified in the cotton mill industry and the centralization of power in mills, the inventor of the Manning boiler, a member of the society since 1884 and until last December, when he resigned, general superintendent of the Amoskeag Mfg. Co., Manchester, N. H. The petition to the council, Dr. Goss explained, was made by 12 members, of whom the first was Rear Admiral Benjamin Franklin Isherwood, retired chief engineer, U. S. N., and the last E. D. Leavitt, Cambridge, Mass., the second president of the society.

Some of the Papers Discussed

The patent question was introduced by a paper by Edwin J. Prindle, Prindle & Wright, New York City, and resulted in the council's being requested to take appropriate action looking to staying further patent legislation until a competent commission could be appointed. The main points of Mr. Prindle's paper were printed in *The Iron Age* April 17. In response to a direct question as to how far one could go in repairing a machine without interfering with the rights of the patentee, Mr. Prindle said that the purchaser of a machine should not go so far as to make a new machine.

Among other papers read were the following: "Shading in Mechanical Drawing," by Theodore W. Johnson, professor mechanical drawing, U. S. Naval Academy, presenting a new rule for shading; "Test of a Hydraulic Buffer," by Carl Schwartz, first assistant engineer, New York Central & Hudson River Railroad, New York, discussing the performance of a buffer for absorbing energy in bringing trains to rest; "Cost of Upkeep of Horse-Drawn Vehicles Against Electric Vehicles," by Walter R. Metz, superintendent of buildings, Government Printing Office, Washington, reviewed in *The Iron Age* April 17.

The Thursday morning session, given over to fire protection subjects, included the following papers: "The Baltimore High-Pressure Fire Service," by James B. Scott, consulting engineer, Baltimore, some features of which paper are to be given in these columns; "National Standard Hose Couplings and Hydrant Fittings for Public Fire Service," by F. M. Griswold, general inspector of the Home Insurance Company, New York, showing among other things how couplings, ranging in diameter from 31/32 in. to 35/64 in. and having 7, 7½ or 8 threads to the inch have been readily and cheaply modified to couple up with the standard sizes by the use of a standard female ring or swivel having an inside diameter of 31/16 in. with 7½ threads to the inch; "Allowable Hights and Areas for Factory Building," by Ira H. Woolson, consulting engineer of the National Board of Fire Underwriters, summarizing the views of fire marshals and fire chiefs regarding the limits of hights and areas of factory buildings; "Life Hazard in Crowded Buildings Due to Inadequate Exits," by H. F. J. Porter, secretary of the Efficiency Society, discussing a method of bisecting buildings from cellar to roof, to allow all the occupants on one side of the wall to pass through the wall and to close the door, thus emptying that side of the building (which may be 20, 30, 40 or 50 stories in hight) in less than a minute.

Among those present were:

Arthur H. Annan, superintendent Rhode Island Tool Company, Providence, R. I. Edward R. Archer, chief engineer Tredegar Company, Richmond, Va. H. M. Bailey, safety inspector Carnegie Steel Company, Duquesne, Pa. D. K. Bartlett, general manager and assistant treasurer Builders Iron Foundry, Providence. George M. Bartlett, mechanical engineeer Diamond Chain & Mfg. Company, Indianapolis. Luther D. Burlingame, chief draftsman Brown & Sharpe Mfg. Company, Providence. William Phillips Caine, steam expert Tennessee Coal, Iron & Railroad Company, Ensley, Ala. John Calder, vice-president International Motor Company, New York. Emmett B. Carter, chief engineer Midvale Steel Works, Philadelphia. Walter L. Cheney, sales manager Lucas Machine Tool Company, Cleveland. J. Wendell Cole, district manager William Sellers & Co., and Detroit Emery Wheel Company, Columbus, Ohio. Harrington Emerson, efficiency engineer, New York. Robert H. Fernald, professor dynamical engineering University of Pennsylvania, Philadelphia. Charles Fitzgerald, manager of sales and assistant general manager Pittsburgh Valve, Foundry & Construction Company, Pittsburgh. John J. Flather, professor mechanical engineering University of Minnesota, Minneapolis. Walter S. Giele, Harrison Safety Boiler Works, Philadelphia. Henry L. Gantt, consulting engineer, New York. E. W. Greene, sales engineer Alberger Pump & Condenser Company, New York. Prof. O. P. Hood, chief mechanical engineer U. S. Bureau of Mines, Pittsburgh. O. Z. Howard, Griscom Spencer Company, New York. Henry Hess, Philadelphia. Howard M. Ingham, efficiency engineer, New York. Arthur C. Jewett, professor mechanical engineering University of Maine, Orono, Me. H. K. Jones, mechanical superintendent Corbin Screw Corporation, Hartford. W. H. Kenerson, professor mechanical engineering Brown University, Providence. Wilfred Lewis, president Tabor Mfg. Company, Philadelphia. Cav. Gaetano Lanza, professor emeritus Massachusetts Institute of Technology, Philadelphia. A. J. Loepsinger, mechanical engineer General Fire Extinguisher Company, Providence. Thomas H. Mirkil, Jr., vice-president and general manager Poole Engineering & Machine Company, Baltimore. J. P. Mudd, mechanical engineer Midvale Steel Company, Philadelphia. Walter J. Muncaster, vice-president and general manager Cumberland Steel Company, Cumberland, Md. E. H. Neff, New York manager Brown & Sharpe Mfg. Company, New York. Wilber O. Platt, vice-president and superintendent Joseph Reid Gas Engine Company, Oil City, Pa. F. Rodney Pleasonton, engineer Pennsylvania Steel Company, Steelton, Pa. Richard H. Rice, General Electric Company, West Lynn, Mass. N. L. Sammis, Builders Iron Foundry, Philadelphia. Webster V. Gould, New York representative Jones & Lamson Company, Mt. Vernon, N. Y. James A. Kinkead, resident sales manager Parkesburg Iron Company, New York. William F. Austin, superintendent, Eddystone plant, Belmont Iron Works, Eddystone, Pa. H. E. Ehlers, professor experimental engineering University of Pennsylvania, Philadelphia. James W. Nelson, manager Estate of Richard Dudgeon, New York. J. C. Parker, general manager Parker Boiler Company, Philadelphia. Oberlin Smith, president Ferracute Machine Company, Bridgeton, N. J. Clarence L. Taylor, chief engineer Morgan Engineering Company, Alliance, Ohio. Thomas Towne, general manager of sales Union Drawn Steel Company, Beaver Falls, Pa. G. N. Van Derhoef, Eastern consulting engineer Dodge Mfg. Company, New York. A. C. Walworth, president Malleable Iron Fittings Company of Brantford, Conn., Boston, Mass. Samuel T. Wellman, Cleveland, Ohio.

General Electric Sales

The General Electric Company, Schenectady, N. Y., has sold electrical equipment to steel companies as follows: Maryland Steel Company, Sparrows Point, Md., several motors, including four of 10 hp., two 25, one 50, two 100 and four 150; Brier Hill Steel Company, Youngstown, Ohio, a number of motors, comprising three 25 hp., six 30, nine 50, three 100 and five ranging from 20 to 75; Worth Bros. Company, Coatesville, Pa., a 750-kw. Curtis turbo-alternator complete with accessories; Carnegie Steel Company, Pittsburgh, Pa., for the Homestead works, two 400-hp. motors and panels; Burden Iron Company, Troy, N. Y., a 375-kva. generator, with 14-kw. exciter. Among other sales of electrical equipment were the following: Hyatt Roller Bearing Company, Harrison, N. J., a 500-kw. Curtis turbo-generator unit; Boston Woven Hose & Rubber Company, Cambridge, Mass., 18 motors, ranging from 15 to 400 hp., oil switches with transformers and controller panels; Avery Company, Peoria, Ill., a 75-kw. alternator, with 3-kw. exciter, six 25-hp. motors and switchboard.

New Cleveland Offices.—The Cleveland offices of *The Iron Age* have been removed from the American Trust Company Building to 1201-2 New England Building.

Iron and Steel Institute at High Mark

The New York Meeting Has a Record Attendance and Papers Are of Unusual Interest to Operating Men

The fourth general meeting of the American Iron and Steel Institute, held at the Waldorf-Astoria, New York, May 23, brought out the largest attendance in the history of the Institute. The membership had increased from 435 to 872 in the preceding year and therefore this was the first meeting for a good many. It is also evident that these occasions are growing in favor for the opportunities they present to men prominent in the commercial or operating organizations of iron and steel companies to foster acquaintance and exchange views and experiences. More than 350 members registered last Friday, and contrary to what is noticed at the average engineering society meeting a large proportion of them sat through the reading of papers and discussions. The officers of the Institute were re-elected and it was decided to hold the October meeting in Chicago, probably on October 24.

President's Address

The Astor Gallery was well filled when President E. H. Gary opened the session of Friday morning. His address was given without notes or prepared manuscript. He spoke at the outset of the loyalty of the members to the Institute and to those who are trying to care for its interests, and referred to the steadfast friendships which had been formed in the past few years of their associated effort. He was impressed with the number of young men who are coming rapidly forward in the industry. By their training in universities and in practical operations they were qualified to make greater successes than have yet been made. From a memorandum prepared by Secretary McCleary, Judge Gary presented the following concerning the work of the Institute in the past year:

A Year's Work of the Institute

"Since the Institute assembled in this room a year ago the membership has more than doubled, increasing from 435 to 872. A year ago James M. Swank, for forty years the secretary of the American Iron and Steel Association, resigned, to take effect on December 31, 1912. With the retirement of Mr. Swank the association went out of existence. Immediately thereafter, on January 1, 1913, its work was taken over by the American Iron and Steel Institute. The offices of the association in Philadelphia were retained for the time being, and all of Mr. Swank's statistical staff was continued in service. The Philadelphia office has gotten out this year four special statistical bulletins, covering respectively the production in the United States during 1912 of all kinds of pig iron, all kinds of rails, pig iron production by grades, and production of iron and steel structural shapes, wire rods, and cut and wire nails. The annual statistical report is approaching completion, and a new directory of iron and steel works is under way.

"The New York office began in January last the publication of a monthly bulletin which has attracted attention in this country and in Europe. Its total circulation averages 7500 each month, running sometimes as high as 9000. The bulletin serves as a medium of communication between the Institute and its members, and gives to a large number of outside readers information as to the work of the Institute.

"Early this year the Institute published its year book for 1912, giving the proceedings of the two general meetings of the Institute held last year. At the close of this meeting its proceedings will be sent out to members in pamphlet form, and after the October meeting the year book for 1913 will be issued, giving the proceedings of both of the meetings held this year.

"On January 3, 1913, the directors of the Institute adopted as the universal danger sign the red disk that had for some time been used as such by the United States Steel Corporation and some other companies, recommending it for use in all iron and steel plants. The universal danger sign has been adopted by the National Association of Manufacturers and by other industries and associations outside of iron and steel.

"The secretary and the assistant secretary of the Institute and the secretary of the welfare committee have made over fifty visits to iron mines and steel plants, to counsel and advise on safety and sanitation, and other matters in which the Institute is interested. They have also delivered more than seventy-five addresses before business bodies, colleges, schools, churches; have consulted with public health authorities and made many studies of social and hygienic questions and general welfare."

The Business Outlook

Passing to the discussion of questions bearing on the immediate future of the steel industry, Judge Gary said:

"Business conditions at the present time are not as good as we would like to have them. I suppose we would be less than frank if we failed to admit that there has been considerable recession in our business. Possibly this applies to business conditions generally throughout the country. I suppose there are many reasons for this, and I do not think it is a mistake to refer to these questions, because when we know what conditions are, and especially if we know their causes we are better prepared to protect ourselves against any great loss or damage to our affairs by reason of those conditions.

"Of course there are financial conditions throughout the world at the present time that have some effect upon our business, indirectly if not directly. It is impossible to have wars in any country that do not have their influence upon all other countries. It is impossible to destroy property of large value without producing an unfavorable general result throughout the world. I suppose the European wars have directly and materially, perhaps, though I hope temporarily, affected the general financial conditions and markets of the world. There is no doubt Europe has been drawing from this country large sums of money to finance the losses which have been sustained in these pending difficulties in Europe; and not only that, the different countries of Europe have been preparing themselves for war, believing there was a possibility of a general conflict. And in doing this, of course, it has been necessary to secure all the ready money that was available. And I have no doubt considerable money has been taken from this country for these purposes. And therefore there is a slight stringency in the money market in this country which has been felt to some degree. This is about as bad a picture of the conditions as I can present.

"Fortunately the wars are ended. The nations which have not been directly connected with this warfare have so prepared themselves for future conflict that they are almost certain to prevent war. In other words, they have secured peace by great diplomacy and by the expenditure of large sums of money. And not only that, the fighting nations which have been engaged in this terrible conflict have secured peace, although they had to fight for it.

Unfavorable Legislative Features

"I think perhaps worse than the conditions I have alluded to at the present time, certainly so far as applies to this country, is the disposition of legislative bodies to tinker with questions they are not very well prepared to discuss or to decide. It is most unfortunate that a man

who is elected to office, being the average man, or a little below it in some places, has the impression that there is elected into him by the people considerable knowledge which he did not before possess. You gentlemen know by experience that if in the country a farmer or a blacksmith is elected justice of the peace, the people generally, and particularly the official, are of the opinion that there has been elected into the head of this justice of the peace considerable knowledge, and the next day the neighbors all run to him for legal advice. And that is about the situation with reference to a good many of our officials.

"There are pending at the present time in various places questions of legislation which are more or less important, and which may result in temporary injury to our business. I regard as the most dangerous at the present time the disposition of legislative bodies to pass laws which are calculated to produce classes. The man who is in politics, the politician as distinguished from the statesman, seems to consider first of all the question as to how he can secure more votes for himself—first, how he can get into office, and secondly, how he can keep in office. And the disposition of some is to appeal to classes by way of stirring up animosities and for the purpose of arraying what he considers to be the multitude of men, against the few with the idea of stirring up such a feeling of prejudice as to divide the different classes of people into factions and thereby perhaps secure a majority of votes in order to get in or to keep in office. To my mind this is a very serious question.

"I think, for instance, the proposition to assess the incomes of men who have incomes of more than $4,000 and exempting the incomes of those who receive less than $4,000 per annum is one of the worst things that has ever happened in this country, because it immediately arrays 97 per cent. of the people against 3 per cent. of the people. I have no objection to an income tax when and as needed. I believe a man able to pay ought to pay. And I believe in liberal taxation all the time, and in most liberal expenditures of money for the benefit of all the people. I have nothing to say against an income tax as a principle. But to make 97 per cent. of the people interested in favor of an income tax which exempts them and which compels the 3 per cent. to pay these large sums of money is a very great mistake, and it is an innovation in this country to my mind. I cannot look upon it except as the beginning of forcible distribution of wealth, however honestly acquired.

"Now, the reason I speak of this, and the only reason, is that it seems to me the influence of a body of men so prominent as you should be against legislation or any action of this kind. It is so unjust and so unfair and so contrary to the institutions of this country, that we should prevent its adoption if possible and make it unpopular if adopted.

"I have not any doubt that at the present time there is a disposition on the part of some of the leading financiers of the country, and perhaps those whose influence is needed to carry on the best interests of the country, to withdraw their financial support from extensions of various kinds, and that we are feeling the effect to some extent.

Advance in Railroad Rates Would do Good

"Of course in these remarks I am talking, so to speak, to my own family; trying, as I said, to present the worst feature, for the purpose of considering at least, each for himself, what ought to be done and what can be done. On the other hand we have at the present time before us the possibility, and I think the probability, of action by one department of government, the Interstate Commerce Commission, which is calculated to produce very good results. I believe the railroad companies will secure the right to advance their rates 5 per cent. From the standpoint of a shipper and from the standpoint of one who is selfish I do not like to have any business I am connected with pay any larger rates than are necessary; but I cannot help feeling that the railroads are justly entitled to an increase in rates. And when we find a thing is fair and just, it seems to me we ought to advocate it. And if the railroads do get this increase of rates at the present time, as some of us at least expect, I believe they will begin to buy very liberally of our products, and that will have a very decided effect on our business.

"There is another thing that I think the steel men should be particularly pleased with, and that is the attitude generally of our workingmen. I should like to ask you men who have been so much longer engaged in this business than I have whether you have ever known a time when, generally speaking, the workingmen at the furnaces and the steel works have had a better feeling, a more kindly feeling, toward their employers than they have at the present time. Nothwithstanding the agitation to which I have referred, the disposition of the law makers to appeal to the masses, the efforts which have been made by some of the leading labor agitators, whose names I will not mention, the workingmen generally have been unmoved, uninfluenced, and not disposed to antagonize the employers. I think that is one of the best signs of the times. I think if this continues we may hope for a conservative force which will stand shoulder to shoulder with men like you who are endeavoring to promote the best interests of the country and who will have a lasting and beneficial influence.

"The fundamental conditions of this country to my mind were never better. It is the richest country in the world. The wealth of the country is rapidly increasing; the prospects for crops for the coming year were never better than they are now; and there is every reason why, if the country were allowed to prosper, it should advance further and faster day by day than ever before.

Optimism Urged—To-day's Way Better

"So I hope, gentlemen, that we will not lose courage, that we will keep our heads, that we will have in mind that recession in business is not justified by the fundamentals, that it is only a question of time when we may expect improvement. It remains for us to determine whether or not in the steel industry there is going to be a continued depression or an increasing depression. Let us look the facts squarely in the face and let us remember all the time that opportunity for success was never better, that optimism in the country is still fashionable. It is very easy for us to become demoralized, to become suspicious of one another, to look for clouds in the horizon; it is very natural to borrow trouble; and if we get ourselves in the right condition we influence our subordinates in office, we influence our customers more or less, and when the structure called prosperity begins to crumble it is very easy for it to fall.

"I wish some of you could have heard in court a few days since the testimony of Mr. Schwab in referring to old conditions in the iron and steel industry as compared with the conditions of to-day. We have taken a new departure; we have left the old lanes; we have abandoned the old habits; we are dealing in confidence one with the other; we are looking farther ahead than we used to. When prices go off one per cent. we do not immediately run out into the market and put our prices down ten per cent. in order to see if we cannot get ahead of our neighbor and make five or six cents for ourselves, even though we may lose five or six dollars within a week by doing it. The iron and steel industry is in the hands of men now who have the ability and the courage to stand by their guns and refuse to be stampeded by circumstances and conditions and inflammatory speeches which in olden times were calculated to bring about demoralization and distrust.

"And in my opinion it is one of the most pleasant things about the Iron and Steel Institute that while we have not yet reached the plane of activities which we know we will reach and which is certain to bring about greater success than ever before experienced, yet we are making great progress, and we have connected with the Institute men whose influence not only in their own lines of industry but in all the activities of business life are potential. So gentlemen, I say, let us be proud of our position and let us be satisfied that we know what we are doing, and that no legislative body, no inflammatory periodical or speeches, can have any influence upon us in standing together and pushing forward in a proper and rightful way our best interests.

Stand by the Courts

"The great protection for all of us and for all of our interests in my judgment is found in the courts of this country. Not long since I was crossing the street at a corner where traffic was very heavy, the street very wide, and many rapidly moving automobiles passing to and fro,

so that the danger to a pedestrian was considerable. And I noticed in the center of the street a big policeman, and in front of him, almost in his arms, was a little boy about seven or eight years old, on roller skates, who had been trying to make his way down the street and had become somewhat confused by the numerous automobiles and was in danger of being run over. And this big policeman, seeing the situation, caught the young lad in his arms and held him there until the vehicles had passed out of the way, and then the little lad was allowed to cross the street and get to the sidewalk perfectly safe and sound. There was an illustration of the majesty and of the humanity of the law. And so I would urge upon you gentlemen to-day, however weak or strong we may be, however great our difficulties, whatever the controversies may be in the discussions of the topics of the day, after all, in the long run the courts will see that substantial justice is done to all of us, rich or poor, strong or weak. And more than that no man should ask; and all that every one has the right to demand.

"I would impress just one thought upon the minds particularly of the younger men here. Let us never get away from the courts. Let us make it certain we ourselves are doing about the right thing; that no member of this Institute shall justly be accused of intentionally antagonizing or violating the laws of the country, because all of us must finally appeal to them for protection. We have the right to discuss openly the questions which are pending in the Congress of the United States or in any other legislative body, we have the right even to criticise the law after it has been passed and to insist that it ought to be modified or repeated. But when any proposition once becomes a law and until that law is repealed or changed, while it is the law of the land let us, members of this Institute, always stand by the law and do everything we can to see that it is fairly and justly and fully administered.

"The President of the United States recently said that honest business need not be afraid. Well, let us be honest. Let us take him at his word. Let us assume he means exactly what he says. So far as we are concerned let us do the right thing, the fair thing and the just thing by everyone we come in contact with and all who are interested in our deliberations and in our decisions."

Judge Gary's expressions concerning the attitude of legislators and concerning the better conditions prevailing in the steel industry in the era of better acquaintance among manufacturers were heartily applauded.

Papers and Discussions

Gas Engines Versus Turbo Blowers

The programme of technical papers was then taken up, Heinrich Freyn, Allis-Chalmers Mfg. Company, Milwaukee, giving a 30-minute synopsis of his paper on gas engines, dealing particularly with the results secured at Gary, Ind. A large part of Mr. Freyn's paper, together with the discussions of Arthur West and Richard H. Rice, appear elsewhere in this issue. Mr. West gave figures for the South Bethlehem blast furnace gas engines, reduced to the basis of an eight-furnace operation such as that at Gary. Mr. Rice spoke from the standpoint of the General Electric Company and the results secured from the Curtis turbine.

Iron Ore Reserves in the Eastern Mesaba

George A. St. Clair, Duluth, Minn., gave an interesting paper on the "Eastern Mesaba Magnetic Range." He pointed out the districts from which the future supplies of washed or concentrated iron ores can be drawn. These ores are of the same general character as the lean magnetites which form enormous bodies in portions of Minnesota, Wisconsin and Michigan, and which have been considered by explorers heretofore as of no value. The eastern Mesaba range of magnetic ores extends 80 miles from Town 60, Range 13, St. Louis County, to South Lake east of Gunflint in Cook County, Minn. At this point the formation crosses into Canada. At widely separated points diamond drilling has shown an ore thickness of 100 to 700 ft. Estimating a length of 80 miles, a width of 2000 ft. and a depth of 150 ft., gives over 126,000,000,000 cu. ft. Allowing 20 cu. ft. to the ton, gives over 6,000,000,000 tons of ore, averaging about 36 per cent. in iron.

BILLIONS OF TONS FROM CONCENTRATION

The eastern Mesaba district seems to be a great quarry. In the author's opinion the ores may be used either by metallizing or sintering. The Grondal briquetting process, or sintering, or the Jones metallizing process could be used to make these ores valuable. For the 60 years the Lake Superior region has been worked, a little over 574,000,000 tons has been produced. On the other hand those who come after will have the use of: first, the known good ores, variously estimated as from 1,750,000,000 tons to 2,500,000,000 tons; second, 67,000,000,000 tons of concentrated ores which the various ranges can furnish when the demands of the future become insistent for their exploiting and enriching. The author spoke of the concentrating operations at Coleraine, Minn., where hematite ores are being treated, and at Hawkins, Minn., where the International Harvester Company operates. In these cases washing is resorted to, but for the great mass of hematite whose gangue is of a solid character, recourse must be had to the rock crusher, supplemented by the rolls, to bring the ore to a stage where in certain instances water again will aid in their conservation, eliminating the silica quite largely. The author beleves that a standard ore of at least 63 per cent. iron will be the product derived from the eastern Mesaba magnetites.

Contrasts of Adirondack and Mesaba Magnetites

Sheldon Norton, of Witherbee, Sherman & Co., Mineville, N. Y., in discussing Mr. St. Clair's paper, said that from his investigations in visits to the Lake Superior region, including the eastern Mesaba, which is a mass of lean magnetic iron ore, he was convinced that the whole north shore of Lake Superior is one large iron-bearing region. He did not believe Mr. St. Clair had overrated the possibilities of this district as a future source of supply. "Whether we call the quantity ten billion or two hundred billion tons, matters very little; the amount is so great that for generations to come it certainly will not be exhausted." The ore in the eastern Mesaba district was a sedimentary deposit differing from the western Mesaba hematite in that in the latter the bands of silicious material have become softened by time and the elements, while in the eastern Mesaba the bands of silicious material are solidified and almost vitrified and the iron has become a magnetic oxide.

ENORMOUS IRON ORE SUPPLIES OF THE COUNTRY

Mr. Norton agreed with the author as to the enormous extent of the ore deposits of the country. He pointed out what he presumed some might not credit, that in New York State there are probably as many tons of Clinton red hematite as in the State of Alabama, the difference being that in Alabama the deposits are bunched together in thick, heavy bodies, yet the average iron content in New York State is probably four to five per cent. more than in the Alabama ores. In New York, New Jersey, Pennsylvania and North and South Carolina Mr. Norton estimated there were two billion tons of magnetic ore. The recent perfection of mechanical devices for concentrating and otherwise treating such ores would make them in time a commercial product. In New York State, Witherbee, Sherman & Co. own at least two-thirds of all the coarse crystalline magnetite now known. The ore on their properties is estimated at 210,000,000 tons. The titaniferous ores of the Adirondacks, amounting to 80,000,000 to 100,000,000 tons, will some day be useful as they can be mined from open pits and the titanium can be reduced.

It has been shown by the operations of the Cheever Iron Ore Company, near Port Henry, N. Y., that 30 per cent. magnetite can be mined under ground, crushed and prepared and loaded on cars at a reasonable price. The question that needs most careful study is not so much one of separation but of preparation. Magnetic ore must first be prepared so that the particles of magnetite are broken loose from the non-magnetic particles. For wet magnetic separation Mr. Norton thought that a machine designed

by Palmer in 1828 and used at Palmer Hill, Clinton County, New York, embodied the fundamental idea for the separation of fine material. This machine failed because the inventor had nothing but ordinary magnets, but with the electro-magnets of to-day it could be worked out to a success.

FINE GRAIN OF EASTERN MESABA ORE A DRAWBACK

Referring to the feasibility of concentrating the eastern Mesaba ore, Mr. Norton said that in view of its being so fine grained and of such excessive hardness its preparation with any mechanical device at present available for the work would be very costly. The resulting concentrated ore would be of such fineness as to require additional expense for sintering or briquetting. These ores will no doubt be used in the future when present difficulties are overcome, either by an advance in the selling price of iron ore or a reduction in the cost of preparation. On the other hand, the magnetites of the Lake Champlain district are coarsely crystalline, easily crushed, and the cost of preparation and separation is comparatively small. The writer believed that with the large quantity of material available in the Adirondack district a modern iron and steel plant could be built at tidewater which could produce iron and steel for foreign and domestic use at as low a cost as at any point in the country.

Advances in Steel Works Surgery

Two papers on the welfare work of steel companies were presented by Dr. William O'Neill Sherman, chief surgeon Carnegie Steel Company, and Dr. John B. Lowman, chief surgeon Cambria Steel Company. They dealt with the importance of first aid to the injured and the value of scientific surgery in industrial companies. The Carnegie Steel Company in the past three years, it was shown, has been able to reduce the number of infected accident cases from 5.75 per cent. to 1 per cent. These cases take three and a half times as long to recover as the non-infected cases. The primary object of first aid, Dr. Sherman showed, is to furnish an aseptic or clean dressing that will prevent infection of the wound; also to supervise the removal of the injured person to the home or hospital and to render appropriate assistance in cases of shock, heat exhaustion, gas poisoning, freezing, etc. The surgical organization of the Carnegie Steel Company is composed of 41 doctors and 25 trained nurses, with 23 emergency hospitals.

In the past year the use of the pulmotor, a machine for artificial respiration, has been the means of saving eight lives. It was stated also that 8000 foreign bodies have been removed from the eyes by doctors and nurses of the company without one complication resulting to an employee. The old-time practice of unskilled fellow employees removing cinders and particles of steel from the eye should be strongly condemned. It is frequently followed by serious complications, even to the loss of sight.

Dr. Lowman said that five or six years ago at the Cambria Steel Company's plant the infection of wounds in various kinds of accidents ran from 5 to 7.5 per cent. It now runs only one-fourth to one-half of one per cent. and should be lower. From 1900 to 1905 the Cambria Steel company employed from 12,000 to 14,000 men. There were 347 amputations, including fingers and toes. From 1906 to 1912, when the tonnage was the largest in the company's history, and from 19,000 to 21,000 men were employed, there were only 271 amputations, including fingers and toes. Some interesting views were given of present methods of surgery in accident cases, including one illustrating the use of vanadium steel in the repair of fractured bones.

Officers Re-elected

A buffet luncheon was served in rooms adjoining the Astor Gallery and the intermission following the morning session was a delightful social feature of the day. A meeting of the directors of the Institute was held and the present officers were re-elected: President, E. H. Gary; first vice-president, Powell Stackhouse; second vice-president, Willis L. King; third vice-president, Charles M. Schwab; treasurer, Edward Bailey; secretary, James T. McCleary. The autumn meeting, it was decided by the directors, will be held at Chicago in October, probably on Friday, October 24. Cleveland and Birmingham also presented invitations.

Afternoon Session

A paper on "By-Product Coke Ovens" was presented by Carl A. Meissner, of the United States Steel Corporation, at the opening of the afternoon session. Liberal extracts from this paper, which was encyclopedic in its compass, are given on other pages. It represents the most thorough-going treatment the subject has had before an American society. Interesting discussions by William H. Blauvelt, consulting engineer Semet-Solvay Company, Syracuse, N. Y., and by Christopher G. Atwater, American Coal Products Company, New York, will be published later. The German standpoint will be presented in a discussion which is yet to come from Prof. Oscar Simmarshach, of the Königliche Technische Hochsahule, Breslau, Germany.

George P. Early, special agent American Sheet & Tin Plate Company, discussed "Claims and Their Adjustment," a subject of vital interest to both producers and consumers of steel products, in a paper to be published next week.

We reserve for later publication the third paper of the afternoon, that of Prof. Albert Sauveur on the "Practical Value of the Microscope in the Iron and Steel Industry." It was discussed by Bradley Stoughton, New York, and by John S. Unger, manager research laboratory, Carnegie Steel Company, Duquesne, Pa. In a later issue will also appear the paper of Harry Coulby, president Pittsburgh Steamship Company, describing the marvelous development of "Transportation on the Great Lakes."

The Prevention of Fatigue

The last paper of the afternoon, and one that in spite of the lateness of the hour was listened to with close attention, was that of Dr. Thomas Darlington, secretary of the Institute's Welfare Committee. He answered the question "What Causes Fatigue?" In modern industry he knew of no question of greater importance so far as human activity is concerned than the causes of bodily fatigue and measures looking to the prevention of overtiredness. With great clearness and in a way which increased the interest of his hearers as he went along, Dr. Darlington discussed the fundamentals of hygiene upon which fatigue and efficiency depend and urged that labor be made a physiological rather than a pathological exercise. A number of the considerations he brought out were of special importance to employers of labor who have control to an extent of the conditions under which their employees live.

The Annual Dinner

So many acceptances had been received for the annual dinner that the ballroom of the Waldorf-Astoria was required rather than the places which had been the scene of the Gary dinners. The guests sat in groups of eight at a table, while at the main table were the directors of the institute with the speakers.

Technical Training and Specialization

In the after-dinner programme Prof. Frederick Crabtree, Carnegie Institute of Technology, Pittsburgh, discussed the question, "In What Direction Is Technical Education Tending—Toward Specialization or Toward Grounding in the Broad Sciences?" Referring to the four, five and six year engineering courses, the last two including post-graduate work, Prof. Crabtree said that the proportion of students taking post-graduate courses is small. The consideration of the subject thus limits itself to the undergraduate scientific or engineering school. The advisability of lengthening engineering courses has been much discussed in recent years. Employers seemed to expect a technical graduate to know everything or to be able to solve almost every kind of problem. Frequently the criticism arose that technical graduates were disappointing—were failing to succeed in the higher positions in the industries—because of their narrowness of view, their lack of the sense of proportion and their failure to grasp the importance of commercial points of view as well as the

technical aspect. As to the advisability of adding another year to the school courses there is a great diversity of opinion. The speaker quoted from a number of presidents of technical schools, some favoring a five years' course and others strongly opposing. While from the teacher's standpoint the five years' course offers the easier solution of the problem, the great majority of students will take only the four years' course. The problem then is as to the division of time. To give any considerable specialization would restrict the work to a very narrow range, making the graduate one-sided and greatly limiting his field of usefulness. To give a fairly thorough training in the fundamental studies, such as mathematics, physics, general chemistry, mechanics and drawing, and to give such a reasonable introduction to electro-technology and elementary mechanical and civil engineering as is indispensable, requires so much of the time that comparatively little is left to divide between general studies and specialization in any particular field of engineering. To leave out the general studies is undesirable; the only alternative, then, is to give a certain amount of them and attempt only a fair, clear introduction to the special engineering fields—civil, electrical, mechanical, chemical, metallurgical, etc.

The student would generally prefer the intense specialization and would elect it if given the opportunity, but the trend of opinion now is against it. When the student enters the mill or shop he must specialize and specialize thoroughly. He can then do it to advantage; but no amount of time spent in a technical school laboratory alone will make a man a good blast furnaceman, a skilled steel maker, a competent roller, bridge builder or superintendent of an electric plant. The speaker's conclusion was stated in the following: "For the great majority of men the logical time for intense specialization is after they have entered commercial life and have found a congenial niche in the industrial organization. It does not follow, of course, that all, or even a majority, of the graduates are going to be high-grade engineers or give perfect satisfaction to employers. The technical school cannot always counteract the effects of all of the boy's previous training, including his home life. All that can reasonably be expected is that it will develop as much as possible the latent abilities of the young man, train him in efficient, scientific methods and habis, and afford him a basis upon which he can build his own engineering ability. Success must come through his own energy, perseverance, tact, and ambition. These the school cannot put into him."

Carnegie Steel Company's Training School

John McLeod, assistant to the president Carnegie Steel Company, opened the discussion on Prof. Crabtree's paper. The speaker had gathered from the paper that there is some uncertainty in the minds of educators as to the proper treatment of the post-graduate course. Since the undergraduate courses produce the vast majority of young men who come to the steel industry he suggested that the school of life might be treated as the real post-graduate school.

To find the proper men to fill positions made vacant by removal to other spheres of usefulness, or the new positions created at times for new lines of work, causes as much concern to the executives of steel companies as any question they have to consider. In recent years a number of large companies have taken a great interest in the training of young men and there have been established corporation schools which have formed themselves into the National Association of Corporation Schools. The motive of all these schools is to adjust the knowledge obtained at the school by the young men to its application in factory and railroad operations. The work is divided between the young men who have a good foundation in education and those who have come from the lower school grades. Of the work done by the Carnegie Steel Company in this direction the speaker said:

"The company with which I am connected has started a school where a selected number of young men will be given a two years' course in the process of steel making. This course consists of six months at the blast furnace, six months at the open-hearth furnace, and one year in the semi-finishing and finishing departments in our rolling mills, together with other details, such as inspection, transportation, etc. These men are under the observation of the proper parties at our mills who have been assigned that duty. Records are kept of their performance, and copies of these records are placed with the chief of our bureau of instruction for reference when needed.

"The chief of our bureau of instruction will call these men together from our several mills at stated intervals, to make sure that none of them are missing any of the essentials in the course they are taking. Papers will be prepared by them on the various questions of interest connected with this course, and the usual discussions of these papers will follow.

"The motive of this course is to give an opportunity to those young men to develop for themselves the department of steel making for which they may be peculiarly fitted. While taking this course they are made a part of the personnel of the department in which they are working, and they are subject to the regular discipline of the department the same as the other workmen with whom they are associated. After taking this course they can be assigned to the department for which they are best suited. And we feel they will be more valuable to that department because of their general knowledge obtained during their two years' experience under careful supervision."

In concluding Mr. McLeod suggested co-operation between manufacturers and those in charge of technical schools: "How careful should we be with those young men who come to us with a rather indifferent foundation in education! We have sometimes what we might call indifferent raw materials of other kinds, but we put them under the close observation of our best experts in order to determine whether it is not possible to bring them within the sphere of usefulness. When these young men who are indifferently prepared come to us, why should we not profitably put them under intelligent observation to get from them the maximum good?

"It will be seen that the post-graduate idea is being considered by the employers of the products of our schools and colleges. And we certainly want educators to feel that we have a vital interest in their educational work, and that we invite their aid in helping us direct our efforts in obtaining the very best possible results for the young men and for ourselves.

"I call your attention to the closing paragraph in Professor Crabtree's paper, wherein he calls attention to a joint committee, including representatives of all the national engineering societies, that has been appointed to study the entire field of industrial and technical education. He also invites advice from you gentlemen who represent one of the largest, if not the largest, of the enterprises of our industrial life. I can see in his closing statement an opportunity for the employer and the educator to get together for the common good."

Prof. Henry M. Howe also ably participated in the discussion of the question.

Judge Gary called on Charles M. Schwab, James A. Farrell, Joseph G. Butler, Jr., and James H. Hoyt for remarks of an informal character. Mr. Butler led the guests in honoring the memory of J. Pierpont Morgan by a silent toast as they stood in their places, the speaker referring to him as probably the greatest American of the 19th century.

Mr. Schwab, referring humorously to his recent appearance on the witness stand in the Steel Corporation suit, told of hunting up in advance "The Confessions of St. Augustine"; but in these he found only the confessions of human frailties. It seemed that in those days there were no men who had built up large institutions and who afterward had to confess to what they had done in this direction. To-day the things that were once highly commended are made out to be the worst things. Mr. Farrell congratulated the Institute on the character of the papers presented at the three sessions of the day and expressed his appreciation of the contribution of Prof. Crabtree to the discussion on technical education. Mr. Hoyt, in referring to the attributes of great men, said that the chief of these was patience. He considered that Judge Gary had given an example of it in his address of the morning in which he upheld the majesty of the law and declared it to be the duty of good citizens to support it. He considered that the address rose to a great hight and in it the president of the Institute showed that he possessed that highest attribute, patience.

The Gas Engine in the Steel Industry*

Installation and Operating Costs of Blast Furnace and Steel Works Gas Power Plants Compared with Other Types of Power Plants

BY HEINRICH J. FREYN†

Since 1900, American gas-engine builders have furnished about 500,000 hp. of gas engines in units above 500-hp. capacity, the great majority of which are operated on blast furnace gas. Within the last two years, however, the demand for gas engines seems to have fallen off, and only comparatively few gas-engine installations were put down in this country. It is time to analyze the underlying causes and to endeavor to clear our minds concerning the economic position of the gas engine as compared with that of the steam turbine and the turbo-blower.

Gas engines to-day are used almost to the exclusion of steam turbines and turbo-blowers in German steel and coke oven plants, and the demand for large gas engines is so great that the five foremost engine manufacturers in Germany alone are building such engines at the rate of about 120 per year. To-day we claim the blast furnace and coke oven plants as the natural field for the large gas engine and the field where its greatest development will lie in the immediate future. In the enormous field of power generation directly from coal in the large central power plants of our cities, the steam turbine is in undisputed possession and will doubtless remain so until the producer gas plant or gas turbine reaches a further stage of development.

The Question an Economic One

Let us assume a blast furnace plant of eight furnaces of about 450 tons capacity each, producing about 3600 tons of pig iron per 24 hr. The amount of blast furnace gas generated in this plant will be 22,500,000 cu. ft. per hr., since it is generally agreed that 150,000 cu. ft. of gas is liberated per ton of pig iron produced per 24 hr. This gas will have an average heat value of 95 B.t.u. per cu. ft. Of this total quantity, about 40 per cent., or 9,000,000 cu. ft., is used for heating the blast in the stoves or lost by leakage.

For gas blowing engines, about 2600 b.h.p. per furnace are required, which consume, at the rate of 12,000 B.t.u. per b.h.p. hr., about 330,000 cu. ft. of gas per hr., or for eight blast furnaces 2,640,000 cu. ft. An additional quantity of 460,000 cu. ft. per hr. for eight blast furnaces will be necessary to produce in gas electric engines the required power to operate the furnace auxiliaries, such as air compressors for mud guns, skip hoists, ore handling machinery, transfer cars, bells, lighting, and so on.

The total quantity of blast furnace gas which has to be deducted amounts thus to 12,100,000 cu. ft. per hr. In other words, there will remain for use, outside of blast furnace operation, 10,400,000 cu. ft. per hr. This quantity of gas represents at a heat value of 95 B.t.u. per cu. ft. the total amount of heat of 1,000,000,000 B.t.u. per hr.

To make use of this available quantity of heat for power generation, gas electric engines or steam turbo-generators can be installed. In the former case, the available quantity of heat will produce at the rate of 16,200 B.t.u. per kw-hr. at the switchboard, corresponding to an average thermal efficiency of 21 per cent., a total of about 60,000 kw. (90,000 b.h.p.). If this available quantity of heat is converted into power through gas-fired boilers and steam turbo-generators, the maximum capacity of the power plant would be about 30,000 kw. (45,000 b.h.p.) if a heat consumption of 32,500 B.t.u. per kw-hr., or a thermal efficiency of 10.5 per cent. of the steam plant is assumed.

Experience at Gary

Such conditions exist to-day in this country at Gary in the largest steel plant in the world, where gas-engine generators of a total capacity of about 68,000 kw. maximum continuous rating will be in operation within a few months. During the last year the maximum continuous rating of this plant was 50,000 kw., and the average use factor, including Sundays, was 64.5 per cent. Assuming the same use factor in the future, when the plant capacity will be 68,000 kw., and deducting the Sundays, the use factor for 313 working days would be 76 per cent., so that 52,000 kw. will be generated every working hour to meet the power demands of the steel plant itself and of the allied industries located in its vicinity.

If in this steel plant steam turbines had been installed, only one-half of this power demand could have been covered by burning blast furnace gas under boilers, so that for the remainder of 30,000 kw., it would have been necessary to use steam coal. Assuming a coal consumption per kw-hr. of 3 lb. of Illinois coal of 10,500 B.t.u. per lb., which would correspond to 10.8 per cent. thermal efficiency at the switchboard, there would have been required $3 \times 30{,}000 \times 24 \times 313 = 676{,}000{,}000$ lb., or 300,000 gross tons of coal per year. At a price of $2.50 per gross ton as fired, which is the prevailing price in that locality, the total expenditure for coal per year would have been $750,000.

As gas electric engines were installed in this plant, the requisite additional power of 30,000 kw. is obtained by utilizing directly that portion of the available blast furnace gas which, in the case of steam equipment, it would have been necessary to replace by coal; so that the cost of coal, less the difference between fixed charges and operating expenses per annum of a 30,000-kw. gas engine plant and a 30,000 kw. steam turbine installation represents the actual annual saving with which the Gary blast furnaces must be credited.

A gas engine power plant of the required capacity of 30,000 kw. can to-day be duplicated for less than $90 per kw. maximum continuous rating, all legitimate expenses included. A steam turbine plant, with boilers, economizers, superheaters, condensers, pumps, coal and ash-handling machinery and other auxiliaries for boiler and turbine operation would cost, under steel mill conditions, from $65 to $70 per kw. maximum continuous rating.

Figuring on 15 per cent. fixed charges per annum and $70 per kw., there has to be deducted from the gross saving of $750,000 the product $0.15 \times 20 \times 30{,}000$, or $90,000.

The operating expense, without fuel cost or fixed charges, of the Gary power plant in 1912, at a use factor of 64.5 per cent., Sundays included, was 0.0824 c. per kw-hr., delivered at the switchboard. The corresponding expense for a steam turbine installation of the requisite capacity and operating at the same use factor, may be assumed about 20 per cent. lower, so that the excess operating cost of the gas engine plant per annum would be $0.016 \text{ c.} \times 30{,}000 \times 24 \times 313 = \$36{,}000$, which amount would further reduce the gross saving.

The total reduction to be made from the gross saving is $126,000, and the net saving per year amounts to $624,000. An eight-furnace blast furnace plant will produce about 1,200,000 tons per year, so that the pig-iron account should receive a gas credit of 52 c. per ton, simply because no steam coal had to be fired to cover the power demand. Incidentally, this saving in cost of pig-iron production represents an equivalent saving of national wealth. That is, it corresponds to a quantity of 300,000 tons of coal put aside annually for our children and children's children.

Savings Shown

With turbo-blowers installed, the situation would be: The total quantity of blast furnace gas from eight blast furnaces, after deducting the gas used for stoves, lost by leakage (9,000,000 cu. ft) and utilized for power purposes of the blast furnace plant itself, but without blowing engine requirements, would be 12,600,000 cu. ft. per hr., since for blast furnace purposes alone, about 900,000 cu. ft. of gas per hr. would now have to be used on account of producing the requisite power for the furnaces themselves with steam equipment. The gas consumption of steam tur-

*From a paper presented before the American Iron and Steel Institute, New York, May 23.

†Allis-Chalmers Mfg. Company, Milwaukee.

bine-driven turbo-blowers of 2900 b.h.p. capacity per furnace at 12 lb. of steam of 135-lb. gauge pressure at the throttle, 125 deg. superheat, 28.5 in. vacuum, and 63 per cent. boiler efficiency, would be about 240 cu. ft. of gas of 95 B.t.u. per b.h.p. hr., or approximately 5,600,000 cu. ft. of gas for eight blast furnaces. The net quantity of blast furnace gas available for outside purposes would thus be 7,000,000 cu. ft. per hr.

If, now, a steam turbine plant were put down to utilize this quantity of gas for generation of electric power, there could only be produced about 20,000 kw. (30,000 b.h.p.), while the difference of 40,000 kw. between the actual power demand and the power supply by blast furnace gas would have to be made up by firing coal under boilers. Assuming the same values as previously regarding the thermal efficiency of the turbo-generator plant, there would be required 400,000 tons of coal per year, which, at a purchase price of $2.50 as fired, would be worth $1,000,000 annually.

From this gross saving, the difference in fixed charges and operating expense between gas engine and steam turbine plants must be deducted, as before, so that the actual net saving would amount to $832,000 per annum. The gas credit would now be about 70 c. per ton of pig iron produced.

These figures are nothing short of appalling, and the savings are so tremendous that any argument of gas-engine opponents is silenced. And, no matter what reasonable claims are made in favor of steam turbo-blower and steam turbine equipment for the great steel plant at Gary or any other plant of similar character, the saving, due to the installation of gas engines, remains so stupendous that the old controversy, steam or gas power, is once for all disposed of in favor of the gas engine. In the calculations, the price of coal was assumed to be $2.50 per gross ton as fired. In the Pittsburgh district, for instance, with coal of 13,500 B.t.u. at $1.70 per gross ton as fired, the annual net saving by gas engines would be about $285,000, with gas-blowing engines and $385,000 with turbo-blowers. It is hardly necessary to mention that the saving at Duluth, where coal of 13,500 B.t.u., per lb. costs $3 per gross ton as fired, would be so great as to forever eliminate the competition of turbo-blower and steam turbine.

Analysis of Cost of Power

The cost of power production is, however, not the only consideration which should enter into the calculation; for frequently other, not purely financial factors, when put on the right side of the scales, may radically change the ultimate result. Such influences of practical nature, and to which monetary values cannot always be assigned, are, for instance, the upward tendency of the fuel market, the chances for future extension, the direct or indirect bearing of the type of prime mover selected upon other departments of the industrial enterprise for which the equipment is intended, and last, but not least, freedom from irregularities in fuel supply, which may arise from car famine and strikes.

At the Cockerill Works at Seraing, the old, single-acting gas-blowing engines, which were installed in 1900, are still in use. And even the first 200 hp. blast furnace gas engine, built at these works in 1898, although of obsolete type, is still performing its work quite satisfactorily. The largest gas engine power plant in the world, that at Gary, has now been in operation over five years, but even the most pessimistic investigator would have to concede that the Gary gas engines are good for at least another term of five years. Seven per cent. depreciation figured on gas engines does not mean that these engines will be useless at the end of ten years' time because of wear and tear or on account of age or decrepitude, but simply that they must be written off in that time, due to obsolescence. It would not be prudent to reckon with more than ten years' life of the equipment, because new inventions may revolutionize our present methods of power production so completely that it would be impossible for financial and economic reasons to mantain profitably the old equipment.

The work of reducing the costs on the books to the true figures which can consistently be charged to these plants, is not simple. It was done about two years ago with utmost accuracy for the gas engine installations of the United States Steel Corporation. It was decided to follow the practice customary in steam turbine plant accounting, that is, to base all installation cost figures on the maximum continuous rating of the generator at 40 deg. C. temperature rise. In the majority of cases, the gas engines have a greater capacity in brake horsepower than corresponds to this generator rating, and we agreed to call the maximum continuous rating of these gas engine that kilowatt capacity which at 95 per cent. generator efficiency and 80 per cent. mechanical efficiency, corresponds to a mean effective pressure in the gas cylinders of approximately 70 lb. per sq. in., a value which is universally adopted by gas engine builders.

Table I gives the actual installation costs of a number of gas engine stations in plants of subsidiary companies of the United States Steel Corporation. The figures co-

Table I. Cost of Installation of Blast Furnace Gas Electric Power Plants

Power Plant No.	1	2	3	4	5
No. of units	17	2	4	4	5
Cap. kw., max. con. rating	40,000	4,500	9,000	9,000	11,400
Cap. b.h.p., max. con. rating	56,400	6,400	12,800	12,800	16,300
Cost of installation per kw., max. con. rating:					
(A) Buildings	$9.87	$75.50	$10.17	$10.90	$10.52
(B) Eng. equipment	71.78		72.75	77.78	80.32
(C) Gas cleaning plant	5.85	16.80	14.40	13.00	12.76
Grand total, power plant complete, per kw.	$87.50	$92.30	$97.32	$101.68	$103.60

incide fairly well, with the exception of those pertaining to the cost of gas cleaning plants. The discrepancies among the latter are entirely due to differences of design and local conditions. The gas cleaning plants for the smaller installations are much more expensive than that for the larger power plant, because the latter was originally designed with a view of installing gas engines, so that this gas cleaning plant represents the latest and most efficient arrangement; whereas in the others, gas cleaning plant and gas engine installations had to be fitted into existing plants. Moreover, some of these smaller plants started out with extreme caution in the matter of gas cleaning and provided, in addition to Theisen washers, expensive hydraulic fans, baffle washers and screen washers, with the necessary gas piping. These, however, were subsequently found to be unnecessary and are now inoperative.

All figures give the cost of the so-called secondary cleaning plants only, that is, of that part of the gas washing system which prepares the gas for gas-engine purposes after having been roughly purified in so-called preliminary or primary gas washers. The latter, however, would be part of a steam turbine installation as well, because it was recognized that blast furnace gas should be purified at least to a certain degree of cleanliness, even for stove and boiler purposes.

In Table II, the cost of installation of gas blowing engines in the same plants is given. To obtain a uniform basis for comparison, it is assumed that each furnace is blown by 3 tubs or 1½ gas blowing engines in all plants under consideration, and requires 45,000 cu. ft. per min. displacement of air. The maximum continuous capacity of all engines was based on this quantity (30,000 cu. ft. displacement per engine) and 25-lb. blast pressure. The rating of all engines was determined assuming 18 lb. per sq. in. mean effective pressure and 90 per cent. mechanical efficiency of the air tubs themselves, with the exception of one plant, where high-speed gas blowing engines are installed.

It can be seen from these cost figures that the equipment with high-speed gas-blowing engines is a good deal cheaper than that of slow-speed engines, especially when the capacities of Plants 1 and 3 are considered. While none of the figures represents the lowest cost which could be obtained if similar plants were installed to-day, it will be admitted that they are quite a good deal better than such plants are usually given credit for.

The total cost of the new power house at Gary, containing 10 units of 2700-kw. each maximum continuous rating, when completed, will probably not be over $70 per kw., without the gas-cleaning plant. The latter would bring the cost of the whole station to a little over $75 per kw. Prominent central power station engineers in this country agree that the cost of a steam turbine power plant per kw. maximum continuous rating varies from $60 to $100, and it is generally conceded that the average is near $80 per kw. There are not many lighting or street railway power plants in this country which cost less than $65 per kw., and the majority of these plants have capacities

Table II—Cost of Installation of Blast Furnace Gas Blowing Engines

Plant No.	1		2		3		4		5	
Number of Units Installed	16		4		6		4		4	
Capacity Installed, B.H.P.	42,000		10,500		14,000		10,500		10,500	
Capacity Operating, B.H.P.	31,500		7,875		14,000		8,000		8,000	
Total Displacement of Operating Engines, cu. ft. per minute	360,000		90,000		180 000		90,000		90,000	
Investment per B.H.P. installed:		%		%		%		%		%
(A) Buildings	$7.87	10.7	$59.70	88.4	$8.99	12.0	$10.69	13.8	$10.75	12.7
(B) Engine Equipment	61.40	83.1			55.20	74.0	60.05	77.3	67.40	79.4
(C) Gas Cleaning Plant	4.58	6.2	7.88	11.6	10.07	14.0	6.98	8.9	6.79	7.9
Total	$73.85	100.0	$67.58	100.0	$74.26	100.0	$77.72	100.0	$84.94	100.0
Investment per B.H.P. Operating:										
(A) Buildings	$10.50	10.7	$79.50	88.4	$10.92	12.0	$14.06	13.8	$14.20	12.7
(B) Engine Equipment	82.00	83.1			70.43	77.0	78.94	77.3	88.90	79.4
(C) Gas Cleaning Plant	6.10	6.2	11.81	11.6	10.07	11.0	9.19	8.9	7.90	7.9
Total	$98.60	100.0	$91.31	100.0	$91.42	100.0	$102.19	100.0	$111.00	100.0
Investment per cu. ft. Displacement of Operating Engines:										
(A) Buildings	$ .92	10.7	$6.97	88.4	$ .85	12.0	$1.25	13.8	$1.26	12.7
(B) Engine Equipment	7.18	83.1			5.47	77.0	7.02	77.3	7.88	79.4
(C) Gas Cleaning Plant	.54	6.2	1.03	11.6	.78	11.0	.81	8.9	.79	7.9
Total	$8.64	100.0	$8.00	100.0	$7.10	100.0	$9.08	100.0	$9.93	100.0
Investment for 500 ton Blast Furnace										
(A) Buildings	$41,500	10.7	$313,300	88.4	$38,250	12.0	$56,250	13.8	$56,500	12.7
(B) Engine Equipment	323,000	83.1			246,500	77.0	315,750	77.3	350,000	79.4
(C) Gas Cleaning Plant	24,200	6.2	46,550	11.6	32,250	11.0	36,750	8.9	36,000	7.9
Total	$388,700	100.0	$359,850	100.0	$320,000	100.0	$408,750	100.0	$442,500	100.0

considerably larger than even that of the Gary gas engine plant, some having as much as 200,000 kw. capacity in steam turbines under one roof.

Under the favorable operating conditions at the Gary plant, the thermal efficiency of the gas engines averages at least 21 per cent., particularly in view of the truly splendid physical condition in which this gas engine plant is kept. If the gas consumption of a gas engine or of a whole plant increases beyond the limit established by tests under similar load conditions, this must be due either to incorrect measuring methods or caused by "deferred maintenance," a term defined by Henry Floy as "the condition into which a power plant is permitted to lapse, due to neglect of proper maintenance and regular repairs."

Net Operating Expenses

The operating expenses, without fuel cost or fixed charges, can be subdivided into the following items: labor, repairs and maintenance, lubricants, water and miscellaneous expenses. For the Gary plant, the cost of these various items for the last three years of operation is shown in Table III.

Table III—Cost of Producing Electric Power at Gary. All Cost Figures in Cents per kw-hr.

	1910	1911	1912
Capacity in kw.	40,000	40,000	50,000
Kw-hr. produced	116,535,000	157,742,510	286,575,000
Use factor, per cent.	33.3	45.0	64.5
Cost of installation per kw.	$88.00	$88.00	$88.00
Labor	0.0678	0.0421	0.0302
Repairs and maintenance	0.0366	0.0305	0.0273
Lubricants	0.0116	0.0100	0.0085
Water	0.0074	0.0057	0.0036
Miscellaneous	0.0064	0.0153	0.0128
Total net operating expense	0.1298	0.1036	0.0824
Value of gas	.....	0.1508	0.1464
Cost of purification	.....	0.0219	0.0144
Total cost of purified gas	0.1951	0.1727	0.1608
Operating cost without fixed charges	0.3249	0.2763	0.2432
Fixed charges at 15 per cent.	0.4520	0.3360	0.2310
Grand total at switchboard	0.7769	0.6123	0.4742

To give an approximate idea, however, of the relative cost of producing electric power in blast furnace gas engine and steam turbine plants in this country, the costs and other interesting data obtained in eight steam turbine stations and eight blast furnace gas-engine plants were averaged, and the results are given in Table IV.

The gas-engine installations in question belong to subsidiary companies of the United States Steel Corporation. Of the ten blast-furnace gas-power plants in the Corporation, two were omitted, because one is of very small capacity and the other has not been in operation over two years. Three of the plants are located on the Great Lakes, four in the Pittsburgh District and one in the Youngstown district. The figures are true averages covering three years' operation, 1910 to 1912.

Attention is called to the great difference in average capacity of the two classes of power plants, which should be noted when comparing the values in columns 2 and 5. It should further be borne in mind that electric light and power plants of public service corporations are organized and operated on a different basis than steel mill power stations. A steel mill power plant is only a means to an end—an auxiliary, as it were, in a vast system which is primarily concerned in the manufacture of steel and not in the production of power. Circumstances could hardly have been more unfavorable for obtaining fair average figures on blast furnace gas engine plants than those existing in the years 1910 and 1911, on account of the unsatisfactory condition of the iron and steel trade in this country. The average use factor for the eight gas engine stations under discussion was 46.3 per cent. and 46.8 per cent. in 1910 and 1911 respectively. In 1912 it rose to 54 per cent. with the result that the cost figures for these plants were substantially improved.

Some very interesting information is available, which permits a comparison between reciprocating steam blowing engines and gas blowing engines in five blast furnace plants in this county. While some of the steam blowing equipment is not new, it will nevertheless be surprising to learn that the average total cost of blowing blast furnaces with gas blowing engines was 53.7 per cent., or a little more than one-half of that with steam blowing engines, all charges except fixed charges included. The average heat consumption of the gas blowing engines in these five plants in 1912 was 30.5 per cent. of that of the steam blowing engines.

The average saving of five gas blowing engine plants over five steam blowing engine installations was $2.52 per "blast unit" (1,060,140 cu. ft. of air at 15-lb. pressure). The importance of this saving will be more appreciated when it is stated that the total actual cost of blowing the eight Gary blast furnaces with gas blowing engines averaged—in 1912—only $3.26 per blast unit. Of this cost, 31 per cent. or $1.01 represents net operating expenses, and 69 per cent. or $2.25 the cost of purified gas. Illinois coal of 10,500 B.t.u. per lb. would have cost $0.42 per gross ton at Gary to reduce the saving, due to the installation of gas engines, to nothing, and to make a steam tur-

Table IV.—Comparison of Cost of Producing Electric Power in Steam and Gas Power Plants. All Cost Figures in Cents per Kw-Hr.

No. Item	Item	8 Steam Turbine Plants: 1 Maximum		2 Average		3 Minimum	8 B. F. Gas Engine Plants: 4 Maximum		5 Average		6 Minimum
1	Plant Capacity in K.W.	126,000		55,000		10,000	50,000		11,600		1,500
2	Use Factor, per cent.	33.3		25.0		10.0	71.5		49.0		22.0
3	Labor	.1730		.0902	58.1	.0434	.0881		.0550	33.0	.0302
4	Repairs and Maintenance	.0740		.0422	27.3	.0250	.1282		.0733	44.0	.0273
5	Lubricants	.0096		.0054	3.5	.0020	.0237		.0125	7.5	.0054
6	Water	.0305		.0143	9.2	.0020	.0162		.0120	7.2	.0036
7	Miscellaneous	.....		.0029	1.9	.....	.....		.0137	8.3	.....
8	Total Net Op. Expense	.2414	33.3%	.1550	100.0	.0850	.2438	52.2%	.1665	100.0	.0824
9	Cost of 1 Million B.T.U. Cents.	11.10		8.80		5.20	10.37		8.11		5.89
10	Cost of Fuel	.3960	66.7%	.3100		.1950	.2441	47.8%	.1530		.0963
11	Total Cost of Power Production without fixed charges		100.0%	4650				100 0%	.3195		
12	Heat Consumption per K.W. Hour B.T.U.	46,400		35,400		29,700	26,000		18,400		16,200
13	Thermal Efficiency, per cent.	11.49		9.65		7.35	21.0		18.54		13.12
14	Ratio of Plant Capacities	1		1		1	.397		.212		.150
15	Ratio of Use Factors	1		1		1	2.130		1.960		2.20
16	Ratio of Net Op'g Expenses	1		1		1	1.010		1.074		.970
17	Ratio of Cost of 1 Million B.T.U.	1		1		1	.934		.922		1.132
18	Ratio of Fuel Expense	1		1		1	.617		.493		.494
19	Ratio of Actual Fuel Cost	1		1		1	.560		.536		.436
20	Ratio of Total Cost of Production	1		1		1	....		.678		....
21	Ratio of Heat Consumption	1		1		1	.560		.520		.545
22	Ratio of Thermal Efficiency	1		1		1	1.830		1.923		1.785

bine installation commercially equivalent to the existing gas engine installation.

In a number of steam turbine plants of greatly varying capacity, in this country, the percentage of the total repair and manitenance cost per kw-hr. averages 27.5 per cent. of the total net operating expenses without fuel and fixed charges, as will be seen when referring to Table IV. The detail percentages for the eight steam power plants of capacities ranging from 10,000 kw. to 126,000 kw. with an average of 55,000 kw. maximum continuous rating, having use factors varying from 10 per cent. to 33.3 per cent. with an average of 25 per cent. are: 23, 11.5, 22, 23, 33, 40, 33, 32, 33.5, 31 and 32 per cent. The corresponding figures applying on eight American blast furnace gas engine plants, varying in capacity from 1500 kw. to 50,000 kw. (average 11,600 kw.) and having use factors of 22 to 71.5 per cent. (average of 49 per cent.) were for three years' operation as follows:

Table V.—Repair and Maintenance Costs Expressed as a Percentage of Net Operating Expenses

Plant capacity kw.	1910 Per cent.	1911 Per cent.	1912 Per cent.
40,000-50,000	28.0	29.5	33.0
11,400	50.5	51.0	61.0
9,000	31.0	35.5	41.0
9,000	50.5	64.5	60.0
5,000	34.5	21.5	17.0
4,500	38.0	31.5	43.5
2,500	55.0	50.5	57.5
1,500	52.5	48.0	51.0
Average, 11,600	42.5	41.5	45.5
Average for three years' operation		43 per cent.	
Average use factor	46.3	46.8	53.9
Average for three years' operation		49.0 per cent.	

Comparison of these figures shows that the average percentage of repairs for eight gas engine installations is just 50 per cent. higher than the average percentage for eight steam turbine plants. This is not surprising if the ratio of use factors (1:1.96) and of plant capacities (1:0.21) is considered. That some of these percentages are very high in several plants has a number of good reasons. The repair costs contain, for instance, replaced piston rods and defective gas cylinders, an expense which will largely be avoided in the future. At any rate, these figures, especially those in Table V., show that gas engine repair costs are not "twice or three times as high as those of steam turbine plants," as is frequently claimed.

The author made the statement some time ago that at least 12 per cent. of the power produced in gas engines is available from the waste heat to operate low-pressure steam turbines, and he is pleased to state that he found that at the Cockerill Works at Seraing a number of 1500-hp. blast furnace gas electric engines are now equipped with waste heat boilers, designed by Mr. Leon Greiner, which actually produce sufficient steam day and night to generate in low-pressure steam turbines an amount of power equivalent to 13 per cent. of the original capacity of the gas engines.

An Encouraging Outlook for Gas Engines

The figures and facts presented were taken from actual records of blast furnace gas engine and steam turbine installations in operation in this country. While the results obtained with gas engines are highly satisfactory and gratifying and should reassure the iron and steel masters of this country concerning the economic advantages of the gas engine for their purposes, they are by no means the latest word in gas engine practice. The new "scavenging and surcharging" system which was recently devised and patented, and which is applicable on new as well as on existing four-cycle gas engines, promises to fairly revolutionize future gas engine methods. This system has been in successful use for nearly two years in a number of plants abroad and its application has made possible an increase of the mean effective pressure and capacity of gas engines of given cylinder dimensions, of 25 per cent. and 35 per cent. above the original rating.

The increase in capacity results in a corresponding decrease in weight and cost per horsepower of the gas engine and the fixed charges of a power plant equipped with scavenged gas engines are thus materially reduced. Moreover, the net operating expenses are lowered while, incidentally, a better fuel economy is obtained. The reduction in first cost which affects not only the gas engines themselves, but also the items "buildings," "foundations," "electrical equipment," "piping," etc., will be over $8 per kw., so that the first cost of a blast furnace gas engine plant will, in the future, not be a great deal higher than that of an equivalent steam turbine plant, including boilers, condensers and other auxiliary equipment essential for economical operation of the steam power installation.

This scavenging and surcharging system, the utilization of the heat now rejected in cooling water and exhaust, together with the improvements in design and construction which experience has taught, make the future of the large gas engine look brighter and more promising than ever.

In conclusion, I desire to extend to the officers of the United States Steel Corporation and its subsidiary companies, my sincere thanks for their liberal and broad-minded action in giving me permission to put before the Institute the results and costs of operation of their gas engine power plants. And I acknowledge with gratitude my indebtedness to C. J. Bacon, Chicago, for his assistance and co-operation in collecting and working up a very considerable part of the data.

Experience with the Single Gas-Driven Blower*

The Question of Gas or Steam Power for Supplying Air to the Blast Furnace

BY ARTHUR WEST

The facts and figures presented by Mr. Freyn are most interesting and valuable and I am anxious to supplement his data as far as may be by means of information which has become available in our experience at Bethlehem. One of the factors mentioned by Mr. Freyn will have an increasingly important bearing on the question of production of power. The rising price of coal makes it more and more imperative that means be taken for decreasing the quantity required. Judging by the experience which all of us have had for a number of years back, the price of coal will continue in all probability to increase, at least at the rate that the past few years have indicated. Mr. Freyn's figures show in two years the following percentage of increase:

Pittsburgh district	7½%
Ohio district	12½%
Chicago district	12½%

Our experience in the Lehigh Valley indicates that the increase in the price of coal is at least as high a percentage as any of those named. The higher the price of coal the less we can afford to burn it under boilers. This price of coal, of course, regulates the commercial application of blast furnace, coke oven and other by-product gases, inasmuch as the gas is worth what it would cost to produce the same amount of heat or power with coal at the current market price. The rising price of coal tends continually to favor gas engine costs as compared with steam turbine costs. Our fuel price condition in America approaches year by year more and more nearly to that existing in Europe. This is the reason that gas engines began in Europe before they started in America. The higher price of coal is the cause of the very generally increasing use of the gas engine in Europe mentioned by Mr. Freyn. Similar conditions must produce similar effects here.

I desire to agree very heartily with Mr. Freyn on his remarks on depreciation rate. The modern manufacturing plant maintains its machinery in thoroughly good repair, so that when the time comes that the machinery in question has been designed out of existence, all working parts will be found in nearly as good shape as when new. The cost of this off-setting wear and tear of power machinery is carried as "repairs and maintenance," and forms part of the legitimate operating costs. The question of what term of years should be employed in writing off a given plant is a question only of making an estimate as to the chances of improvement in power machinery to such a degree as to make it commercially desirable to replace it with a new layout. This operating has nothing whatever to do with the cost of repairs. Such repairs whether high or low will show entirely as operating costs.

An instance of the mechanical condition of blowing machinery which is being taken out on account of obsolescence is that of the horizontal steam blowing engines built for our own plant by John Fritz. These were most excellent engines and, after almost 50 years of use, were as capable of blowing the furnaces the day they were finally shut down as when they first started in operation. The cost of keeping them in this mechanical condition was carried as an operating expense and the reason for removing the engines was, not that they were worn out, but that it was economically necessary to replace them with gas engines. It is an interesting incident that the last of these Fritz blowers was shut down for the last time on the day that Mr. Fritz died.

The only just way of reckoning power costs is to charge the prime mover with the actual cost shown by experience and to charge entirely as a separate consideration a sum against the cost of power sufficient to accumulate a reserve which will replace the equipment when it is designed out of existence in the period of, say, 10 years. The turbine is at least as likely to be designed out of existence in 10 years as is the gas engine. In my personal judgment the turbine is more likely to become obsolete than is the internal combustion engine, both because there is a bigger theoretical field for improvement in the gas engine than is thermally possible in the steam turbine and because of the rising price of coal.

Referring to Table I in Mr. Freyn's paper, I desire to add the following data in Table A, from our own electric power house in Bethlehem. The figures for kw. and b.h.p., maximum continuous rating, and calculated on the basis given by Mr. Freyn.

Table A

Number of units	4
Capacity of kw, max. cont. rating	6,589
Capacity of b.h.p. max. cont. rating	9,290
Buildings and engine equipment	$62.00
Cost of installation per kw.:	
Gas cleaning plant	6.06
Power plant complete per kw	$68.06

The above engines drive generators of the direct-current type and the engines, while built by the Bethlehem Steel Company, are put in at current selling prices.

In connection with Table II, I desire to submit Table B, which is a comparison between the cost of installation of blast furnace gas blowing engines for an eight furnace plant, as described by Mr. Freyn in column 1, Table II, with the cost of installing a similar eight furnace blowing engine plant, based upon the actual cost of our own four-furnace blowing engine plant at Bethlehem. It will be seen that there is a very large difference in first cost. This is due to the fact that the plant described by Mr. Freyn in column 1 was designed to blow a furnace with a twin blower and a half, that is to say, each furnace requires the use of six gas cylinders and three blowing tubes.

Table B

	Column No. 1 (As per H. J. Freyn) (Gary)			Column No. 6 (Based on Bethlehem costs)		
Number of units installed	16 twin blowers			18 single blowers		
Total displacement of operating engines, cu. ft. per min.	360,000			360,000		
Investments for 8 furnaces in		Per cu. ft. displ. of engines	Per cent.		Per cu. ft. displ. of engines	Per cent.
A—Buildings	$330,000	$0.92	10.7	$204,000	$0.567	11.7
B—Engine equipment	2,580,000	7.18	83.1	1,440,000	4.000	82.6
C—Gas cleaning plant	195,000	.54	6.2	100,000	.278	5.7
Total	$3,105,000	$8.64	100	$1,744,000	$4.845	100
Percentage of investment (H. J. F.—Col. 1) to blow 8 furnaces, as compared with column 1		100			56.1	
Total investment divided by tons of pig iron produced per year, assumed as 1,200,000 tons for 8 furnaces, as stated by Mr. Freyn		$2.588			$1.454	

NOTE.—The Bethlehem figures for buildings include building foundations, exhaust tunnel, exhaust stack, traveling crane, etc. Those for engines include engines, foundations and all piping, etc., in engine house erected complete, the engines put in at the current selling price. They also include the cost of a 4000-hp. producer plant for starting; the producer gas is to be cleaned by furnace gas cleaning plant. The figures for the gas cleaning plant include buildings, foundations and crane for Theisen washers, and are all based on actual costs at Bethlehem to produce our existing plant. As mentioned by Mr. Freyn, it is probable that the cost of purifying furnace gas will be very much reduced, due to a number of new devices which are now in the process of commercial trial. In any case, the cost of gas cleaning will not be more than that given and may be very much less.

The plant which we have in operation at Bethlehem is designed to blow one furnace with two independent single tandem gas blowing engines. In this case each furnace requires the use of only four gas cylinders and two blow-

*Discussion of the paper of Mr. Freyn before the American Iron and Steel Institute. Mr. West is manager of the power department of the Bethlehem Steel Company.

ing tubes, or only two thirds of the blowing apparatus required at the plant described in column 1. We have for upward of a year been blowing five furnaces with a total of nine single blowers. The cold blast piping is so arranged that any two single blowers can be operated on any furnace. With nine single blowers for four furnaces there is therefore one spare engine. It has been our experience that this spare capacity is entirely adequate. This is practically proved by the fact that we are now installing in the same power station two more single blowers, the purpose being to operate five furnaces with eleven single blowers, thus keeping only one spare out of eleven instead of one spare out of nine. In Table B we have figured on installing 18 single blowers for eight furnaces, thus providing a spare capacity equal to what we have found in practice to be quite sufficient and more than we will have at Bethlehem when our fifth furnace goes into blast. The sizes of the furnaces in question are 450 to 500 tons in 24 hr., the same as the furnaces of the United States Steel Corporation at Gary.

In connection with Mr. Freyn's Table VII, I desire to submit Table C, which will be interesting as showing compartive costs per million cubic feet of blast and per ton of pig, assuming that in both cases eight furnaces produce 1,200,000 tons of pig per year. Our Bethlehem results are based on the last five months' operation, because it is only since then that it has been possible to segregate our costs in the necessary manner. The costs for the year will be less than the first five months' average shown, because each month of the five shows a slight but consistent decrease as compared with previous months.

Table C

	Cost per 1,000,000 cu. ft. blast		Cost per ton pig	
	Gary results, 1912, H. J. F.	Bethlehem results, Dec. 1, '12, to Apr. 30, '13. Corrected to Gary cost of gas	Gary results, 1912, H. J. F.	Bethlehem results, Dec. 1, '12, to Apr. 30, '13. Corrected to Gary cost of gas
Purification of gas	$0.201	$0.151	$0.0289	$0.0217
Labor	0.282	0.257	0.0406	0.0370
Repairs, maintenance, lubricants and miscellaneous supplies	0.279	0.265	0.0402	0.0381
Water, electric power, works charges	0.076	0.058	0.0109	0.0083
Total, excluding gas	$0.838 (Assumed)	$0.731 (Actual)	$0.1206 (Assumed)	$0.1051 (Actual)
Gas at cost basis (Coal $1.80 per long ton, 10,500 B.t.u.)	$0.760	$0.760	$0.1094	$0.1094
Total operating charges	$1.598	$1.491	$0.2300	$0.2145
Fixed charges, per ton of pig at 15 per cent.*			$0.388	$0.218
Total cost per ton of pig, including operating and fixed charges			0.618	0.4325

*On an investment representing $2.588 per ton of pig iron at Gary (Table B), and $1.454 per ton at South Bethlehem; see Table B.

In comparing the above Table C with Table B, which I submit in connection with Mr. Freyn's Table II, the practical advantage of operating an eight furnace plant with single blowers becomes at once apparent. In the first place, there is a saving in first cost of the plant of $1,561,000 as compared with a plant equipped as described in Mr. Freyn's column 1, Table II. This tremendous saving in first cost is obtained without the sacrifice of safety or convenience. The cost of engine house, engine foundations, etc., is very much less when we have to provide for only 18 singles as compared with 16 twins.

The operating and repair labor per ton of pig are also much smaller as will be seen from the table. It is not hard to see why the cost per ton of pig is smaller when one realizes that the equipment for eight furnaces when blown with 16 twin engines is 64 gas cylinders and 32 blowing tubs, whereas when the same eight furnaces are blown with 18 single engines there are required only 36 gas cylinders 45 x 60 in. against 64 gas cylinders 42 x 54 in., the blowing tubs being 18 as against 32.

The great decrease in first cost also makes a similar saving in fixed charges, and altogether we believe there can be no question as to the comparative desirability of the two types of engine plants. We have had considerably more than a year's experience in operating our plant with single engines in the manner described, and so have found that the arrangement leaves nothing to be desired from the operating steel man's point of view.

As above stated, nine of these single blowers are in operation and two more are being installed at our own plant, and, as of course the officials here of the respective companies know there are now under construction five single blowing engines of this type for the Minnesota Steel Company and five more of the same size for the Maryland Steel Company. They are the only single gas blowing engines in the United States now in operation or under construction, and we believe the adoption of this system has gone a long way toward solving the question of reducing the capital investment for this kind of work.

When blowing a furnace with the engines in question at Bethlehem the speed is 73 to 75 r.p.m. The Minnesota Steel and Maryland engines, being slightly larger, the average speed will be roughly 65 r.p.m. The speed was not cut down because there was any difficulty whatever experienced with the speed of the engines at Bethlehem, but merely because the size of the blowing engine unit became then the same as a convenient electric unit, a number of which we now have on order, the rating of each unit being 5000 kw.

That 75 r.p.m. is a safe and practical speed for such blowing engines is best proved by the Bethlehem actual labor and repair figures given in Table C.

Perhaps a few rough figures would be of interest in regard to the relative commercial advisability of utilizing the surplus furnace gas in modern steel plant by means of gas blowers and gas electric engine versus turbo-blowers and turbo electric generators. These figures only give a different angle to the same problem which has been discussed by Mr. Freyn in so interesing a manner. I have supposed that in any steel plant, all the surplus power which could be made, after taking care of the furnaces, was either sold at a fair price, or, if used in the plant itself, was charged to the department using it at the same price as if it were sold to an outside consumer. Such price per kilowatt-hour would therefore constitute a proper credit to the cost per ton of pig iron made, whether the power be used directly in the mill or sold. This is the method followed by us at Bethlehem as well as in the majority of the large Continental steel plants, where, as mentioned by Mr. Freyn, the power is invariably sold to an outside consumer if the steel plant does not itself require it.

Starting with the data used by Mr. Freyn, the following figures on the best use of furnace gas in any blast furnace plant may be used.

	Cu. Ft.
Gas (95 B.t.u.) generated per ton of pig	150,000
Gas used by stoves, per ton of pig, 40 per cent.	60,000
Remaining gas available for power of all sorts, per ton of pig	90,000
Gas, per ton of pig, consumed by gas blowers	17,700
Gas electric-driven furnace auxiliaries (17 per cent. of blower horsepower)	3,000
Remainder available for gas electric power	69,300
	90,000

Gas per kw-hr., based on Gary results = 16,200 B.t.u. ÷ 95 = 170 cu. ft.

Gas electric power available per ton of pig = 69,300 ÷ 170 = 406 kw-hr.

By Gary results 1 kw-hr. can be made for (including fixed charges and including gas at the comparatively high Gary price.) 4.74 mills per hr.

It is fair to assume that this power is worth either if used in plant or if sold (including operating and fixed charges) 7.75 mills per kw-hr.

Profit per kw-hr. over and above total cost, including fixed charges 3.01 mills per kw-hr.

Power credit per ton of pig = 406 kw-hr. × $0.003 = $1.218 per ton of pig.

Now suppose that turbo-blowers and turbo-generators be used exclusively:

B.h.p.-hr. per ton of pig with turbo-blower at 2900 b.h.p. per furnace = 2900 × 8 × 24 ÷3600 = 154.5 b.h.p.-hr.

B.t.u. per b.h.p.-hr. at 10½ per cent. thermal efficiency = 24,250 B.t.u. per b.h.p.-hr. = 255 cu ft. gas per b.h.p.-hr.

It should be noted that the thermal efficiency of 10½ per cent. is extremely high and depends upon the maintenance of a very high vacuum, superheat and boiler efficiency, which I do not believe would be realized in ordinary every-day steel mill operation. We have, however, taken this efficiency at its maximum.

1 cu. ft. per ton of pig used by turbo blowers = 255 cu. ft. gas per b.h.p.-hr. × 154.5 = 39,400 cu. ft. gas per ton of pig.

B.t.u. per kw-hr. used by turbo generators at 10½ per cent. thermal efficiency = 3410 ÷ 0.105 = 32,500 B.t.u. per kw-hr. = 342 cu. ft. gas per kw-hr.

Then the gas account for a turbo-driven plant would be as follows:

Cu. ft per ton of pig used by turbo-blowers	39,400
Cu. ft. per ton of pig used by turbo electric-driven furnace auxiliaries, 17 per cent. of above	6,700
Remainder per ton of pig available for turbo electric power	43,900
Total cu. ft.	90,000

Turbo electric power available per ton of pig = 43,900 ÷ 342 = 128 kw-hr.		
Suppose this power sold at same price as assumed for gas engines, viz. (mills per kw-hr.)		7.75
Cost of producing 1 kw-hr. with turbo-generators; operating charge (H. J. F.) aver. 8 plants, mills	4.65	
(Actual operating charge of large modern turbo plant in New York is 5 mills per kw-hr.)		
Fixed charges per kw-hr. at $60 per kw, and using use factor per table IV	3.08	
Total cost per kw-hr., including operating and fixed charges, mills		7.73
Profit per kw-hr., mills		0.02
Profit per ton of pig = 128 × $0.002 = (turbo station complete)		$0.026
Profit per ton of pig (gas station complete)		1.218
Excess profit per ton of pig caused by exclusive use of gas power		1.192

Profit per year due to gas power, with 1,200,000 tons annual production of pig, would then be $1.192 × 1,200,000 = $1,430,000.

It will be seen that the turbo plant would have to be put in for nothing in order to make gas power in competition with the gas engine, when the gas engines are charged with all the operating, repair supply and fixed charges which experience at Gary has shown belong to them.

It is a consideration of figures similar to these which has caused our Bethlehem plant to go over to gas power exclusively, which is now the case. We cannot afford the use of the steam turbine except in cases where waste heat, which cannot be otherwise utilized, can be made use of in the steam turbine. As a rough business confirmation of the above figures, it may be noted that when we started on our gas engine installation our coal bill at the Lehigh plant was more than one million dollars per year. I am happy to say that this coal bill has been entirely wiped out. The use of blast furnace gas at our Lehigh plant has been so profitable commercially that we are now in process of driving our Saucon rolling mill plant with coke oven gas engines as fast as possible.

In closing I desire to refer to the practice of handling one blast furnace with one turbine blower. If anything happens to this machine serious trouble will be caused at the furnace. The situation may be saved only by starting up another blower. The writer's experience with another company in the construction of steam turbines is such that he would be quite unwilling to take the risk of starting a steam turbine without taking proper time to warm it up. In case of trouble on the furnaces, therefore, the time lost would be so great as to cause enormous loss and damage to the furnace, since turbine troubles as a rule occur quite without warning. Quite aside, therefore, from the question of relative costs of operation, which are themselves decisive, our management has taken the ground that they would not dare to blow one furnace with one turbo-blower. If two turbine blowers per furnace be provided, the increased first cost will make their use still more unadvisable commercially. Both at the United States Steel Corporation and at Bethlehem we consider it necessary to blow a furnace with more than one blowing engine, and the same theory should, in our judgment, be carried into use of steam turbo-blowers for this purpose.

I desire to thank the officials of the United States Steel Corporation, as well as those of my own company, for the permission accorded us to use the figures here presented, which are mainly valuable because they rest upon actual practice and not upon theory. I also would like to express my sincere appreciation of Mr. Freyn's very able and valuable paper.

The Turbo Blower as a Help to the Blast Furnace*

A Machine Regarded Not Only as Economically Sound but Likely to Improve Smelting Operations

BY RICHARD H. RICE

This paper is a valuable contribution to our published knowledge of the actual results obtained in the large gas engine installations of the country. It is evidently the result of an immense amount of study and its preparation has undoubtedly consumed considerable time, and it is unfortunate that I should attempt to discuss such a paper after having, through an unfortunate series of events, obtained a copy of it only yesterday afternoon. I can, therefore, discuss only in a general way certain features of the paper, reserving to another time extended or detailed analysis of it.

High Efficiency of Modern Steam Turbine Stations

The object of the paper is evidently to show that the field covered by the scope of the paper is so pre-eminently the field of the gas engine that steam turbine designers may as well decide once for all to keep off. However, in making his comparisons with steam turbine installations, the author seems to have used for the steam plants data which refer to installations which have been in use for some time. Progress in modern steam turbine and boiler construction and operation has been so rapid in the last two years that figures which apply to turbine plants now operating do not at all represent the possibilities of plants installed to-day. The paper uses for comparison an overall efficiency for a 30,000-kw. turbo-electric plant of 10.8 per cent., whereas a station installed to-day of the same capacity under modern conditions would have an overall efficiency of at least 13.5 per cent., simply by using apparatus which is now being installed in our power stations; and as a matter of fact such a station is now being built.

It must be borne in mind that we are now speaking of steam turbine stations for electric lighting plants, where the load factor is extremely low as compared with the load factor obtainable in a steel mill. This low load factor decreases the station efficiency and greatly increases its cost. As compared with stations which Mr. Freyn uses for comparison we now have high efficiency turbines which have a Rankine cycle efficiency of 75 per cent. as contrasted with 65 to 68 per cent. for the turbines in the stations which the author discusses. Also we have large boiler units which have been shown to be more efficient than small units, so that by operating such units even at two or three times rated capacity it is possible to use a single boiler unit with a turbine of 10,000 or 15,000 kw. capacity and obtain efficiencies as high as 75 to 78 per cent. in regular practice. Furthermore, by proper choice of the size of units, and by proper study of operating conditions, it is easy to so arrange matters that each unit operating shall be generating at or near its rated capacity, thereby securing the maximum efficiency from it. Moreover, all the details of station equipment are receiving attention to cut down cost of operation of auxiliaries. This explains generally why 10.8 per cent. thermal efficiency of a station on electric lighting load is too low, and why 13.5 per cent. is now easily obtainable.

Unit Costs of Steam Turbine Plants

These new boiler and turbine units greatly reduce the cost of turbo-electric power stations on account of the lower cost per kilowatt of boilers, reduction in number of boiler units and consequent small buildings and foundations; and a decrease in the amount of piping, uptakes, etc. Therefore, instead of a turbine station costing $65 or $70 per kilowatt to-day as mentioned by Mr. Freyn, a more reasonable cost would be $40 to $45 for the size of station which Mr. Freyn is discussing, particularly when the station is installed for a load factor of 75 per cent. Thus we see that the figures in the paper for cost of power stations containing steam turbine units must be reduced to about two-thirds of those assumed for comparison. We also see that using turbine units having Rankine efficiencies of 75 per cent. as contrasted with units which have been used in the paper for comparison having efficiencies of 65 to 68 per cent. we must decrease the steam consumption figures by 9 to 13 per cent.

*Discussion of the paper of H. J. Freyn before the American Iron and Steel Institute. Mr. Rice is identified with the General Electric Company at Lynn, Mass.

(Continued on page 1330)

ESTABLISHED 1855

THE IRON AGE

Published Every Thursday by the

David Williams Company

239 West 39th Street New York

W. H. Taylor - *President and Treasurer*
Charles G. Phillips - - - - *Vice-President*
Fritz J. Frank - - - - - *Secretary*
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Branch Offices

Chicago: Otis Building Philadelphia: Real Estate Trust Bldg.
Pittsburgh: Park Building Cleveland: New England Building
Boston: Equitable Building Cincinnati: Mercantile Library Bldg.

Entered at the New York Post Office as Second-class Mail Matter

Subscription price: United States and Mexico, $5.00 per year; to Canada, $7.50 per year; to other foreign countries, $10.00 per year.

CONTENTS.

Iron and Steel in Our Trade Balance

Our favorable balance of trade in the nine months ending March was $506,257,090. In iron and steel alone the favorable balance was $201,207,540, or 40 per cent. of the total. This, of course, is a very high percentage, but the comparison is made more striking by observing that while as to all merchandise the exports exceeded the imports by $506,257,090, the exports plus imports amounted to $3,309,755,656. On the other hand, iron and steel exports exceeded iron and steel imports by $201,207,540, but the exports plus imports amounted to only $249,823,308. Thus iron and steel comprised only 7.6 per cent. of our foreign trade, but furnished 40 per cent. of the favorable trade balance.

The comparisons here made are according to the official classification of the Government, which has lately excluded electrical apparatus from the iron and steel category, while agricultural implements have never been so included. Were both items included the favorable balance in iron and steel for the nine months would be increased by about $50,000,000.

It is well understood that the favorable balance in the merchandise trade is largely on paper. Were this otherwise there would have to be settlements of very large sums through gold, silver, securities or in some other manner, yet we know that such settlements are relatively very small. There is an unseen balance which equalizes, and a considerable portion of this unseen balance is in freights, in undervaluation of imports, in overvaluation of exports, etc., items which increase as the total volume of trade increases. Hence an apparent favorable balance like the $506,000,000 shown for nine months ending March, with a total movement of $3,300,000,000, is not nearly as good as would be the same balance, with the total movement only half as great. In all merchandise the balance was 15.3 per cent. of the total movement, whereas in iron and steel alone the balance was no less than 80 per cent. of the total.

Our large iron and steel exports are making a very valuable contribution to the strength of the nation. Were these exports suddenly to be cut off a very serious and painful disarrangement would follow, which supposition illustrates the value of the trade being conducted.

The viewpoint is frequently adopted that the great preponderance of iron and steel exports over iron and steel imports is conclusive evidence that a tariff is not needed on these commodities. This does not follow. The export business is secured in competition with other producing countries, and in all competition a seller is strengthened by having one portion of his market so secured that the competitor cannot touch it. One can easily conceive that were the tariff entirely removed foreign producers would undertake sallies into the domestic market, even incurring a loss, in order to discourage us from exporting.

Possibly it would be more to the point to inquire whether there is evidence that the tariff on iron and steel tends to limit our exports of manufactures of iron and steel. Is there complaint by the manufacturers of agricultural implements, who export to the extent of $40,000,000 a year, or the makers of electrical apparatus, with $25,000,000 a year, or makers of sewing machines or typewriters, each with $11,000,000 or $12,000,000 a year, that they could export more largely if the duties on their raw materials were removed?

The iron and steel tariff is commonly discussed with chief reference to the products of the industry proper, from pig iron through billets to finished rolled steel; yet the fact is that of our total iron and steel exports, including agricultural implements, only 35 per cent. in value are iron and steel proper, the remaining 65 per cent. being manufactures of iron and steel, chiefly machinery.

Remarkable Iron and Steel Institute Papers

It has been said in these columns that with the presidents of the large steel companies actively interested in the success of the American Iron and Steel Institute it was likely that data would be presented at its meetings not ordinarily available to the purely engineering socieies. The desire of operating departments to give results of important work has often been checked by the secretive policy of the management. The meeting of the Institute held in New York last week illustrates what may be done when the heads of important corporations set out on a liberal policy of publicity. There are few precedents for such a complete exposition of costs and operating details as appears in the paper on the results with blast furnace gas engines at Gary, Ind. A similar liberty was given the writer of the discussion dealing with practice at the blast furnaces of the Bethlehem Steel Company. The giving of the Gary data to the engineering public is particularly commented on, in view of the fact that the engineers of that plant well knew that their pioneering would be expensive and that others, having the benefit of their experience, might be able to do better both in first cost and in cost of operation.

Another notable departure from the policy of secretiveness is represented in the remarkable paper on by-product coke manufacture in the United States. While a number of articles have appeared in the technical press in the past two or three years describing retort coke oven plants, they have been quite perfunctory in comparison with the volume of information given by Mr. Meissner on the problems with which coke oven engineers have been occupied.

Last week's meeting was an unusual one in the character of its papers and the interest taken in them. Those dealing with welfare work showed that this great movement in the American steel industry is no dilettante or theoretical affair but is being pushed forward with the same thoroughness and insistence upon results that have characterized work ordinarily considered to be more strictly commercial.

The discussion on technical training which came in the evening session was a revalation to many, of the concern our steel companies are giving themselves over the raising up of competent men for executive positions. Many saw this work from a new angle, as one of the speakers told of a large corporation which suddenly raised the question whether it is not as important to have a depreciation account for organization as to have such an account for plant. A study of what some of the leading companies are doing in the training of their young men suggests the great and permanent value of such an investment, in comparison with the taking of insurance on the lives of important men, good as that palliative may be.

The American Iron and Steel Institute now has a membership of nearly 900. It represents the great working body of the iron and steel companies of the country, and their steel output equals that of any three countries of Europe. If the future of the Institute may be judged from what it has done in the past two years, it will not be long in taking a place of first importance as a producer of iron and steel literature.

Engineers for Operating Positions

Severe criticism of the modern organization of the industrial plant, particularly when its problems are largely those of mechanical engineering, was made in his address as retiring chairman of the mechanical section of the Engineers' Society of Western Pennsylvania, by W. E. Snyder, mechanical engineer of the American Steel & Wire Company, Pittsburgh. His main point is that oftentimes a plant is equipped with expensive machinery, while the brains of the operating side are not of the same caliber, and the results are out of proportion to the outlay for equipment. He argues strongly for an organization for which men are selected, as far as possible, on the basis of fitness, more or less latent, for positions of higher responsibility. So far as steel works are concerned, Mr. Snyder is much of the opinion that technically trained men should be more in evidence and that they should pass through positions in the operating department, and not, as is often the case, expected to belong more particularly to the designing end.

The address gives credit for the notable developments in iron and steel in Germany to the large number of technical men occupying important positions as well as various subordinate positions throughout the works and to the close co-operation between them and the technical institutions. The achievements in Germany, it is emphasized, have been made in spite of adverse conditions—low-grade ores, unsuitable coking coals, inadequate shipping facilities, expensive steam coal and the like. Mr. Snyder believes that in many cases in this country there is not sufficient ability in the operating organization to bring the factory equipment to its maximum efficiency. "There has not been sufficient realization of the importance of developing the human part of the mechanism which produces steel, along with the mechanical part." In developing the personnel of an organization, "the specifications of each unit should be considered in exactly the same way as the specifications of a machine are considered." We insist on the principle of advancement by merit in Government service and in many other lines. Why, the author says, should not the same principles be applied generally in a works organization?

The placing of a technical man in a position formerly occupied by a man without technical education does not mean necessarily, it is added, that the technical man will receive more salary than his predecessor; in fact, the opposite is often the case. Yet the aggregate capacity of the organization has been increased, while the expense to the company has not. The equipment in many of the German works would be ridiculed by engineers in this country, yet good results are obtained wholly, Mr. Snyder claims, because of the caliber of the operating organization. For reasons largely financial, some German producers have not provided mechanical equipment to the fullest extent, but they have utilized what they had to the best advantage.

It is not altogether a new issue—this of the precedence of the technically trained man over the man who

has come up in the works with little help from higher school courses. The latter has often won his place on ability to bring things to pass and because he could direct others and get the most out of them. The criticism discussed above has less force today, so far as iron and steel works are concerned, than it had 15 or 20 years ago. The school-trained man who can develop into a superintendent or manager is forging ahead in steel works operations. In fact, the issue of precedence is often more between engineers—metallurgical, mechanical, electrical—than between the man from the school and the man from the works.

Fine Business Opportunities

The professor who writes the editorial articles for Harper's Weekly should confine himself to politics, international questions and social affairs. When he wanders into industrial matters he gets into deep water. In the issue of May 21 an attempt is made to give advice to such manufacturers as "are driven out of their present business by tariff changes." It is suggested, with fine sarcasm, that there may be "an opening for some of them in making better lines of goods than the market now affords." Reference is first made to so-called "plumbing pipes," which it is stated "used to be made of iron and last in use for twenty or thirty years, now they are made of steel and rust out much sooner." Nails are next mentioned, with the remark that "anybody that has shingled a house within ten years knows that wire nails don't last as well by a great deal as the old iron cut shingle nails." Another reference is to tin plate, with the assertion that the "McKinley-bill tin that we get is made on thin sheets of steel (not iron and not tinned thick enough and the whole product is flimsy and has no wear in it." The professor says it would seem that there was a living for somebody in making better goods than here enumerated.

Manufacturers in these lines will smile when they read that if the new tariff should drive anybody out of business an opportunity is here presented to engage in lines which will afford an opening. The editor of Harper's Weekly should know that any plumber can get all the iron "plumbing pipes" he needs. There is no trouble whatever in securing them in the open market. Nor will difficulty be encountered in the hunt for iron cut shingle nails if anybody desires to get them. If any one should earnestly seek for iron sheets coated with tin, he could secure them also. What the editor of Harper's Weekly does not know is that the manufacture of steel has so displaced iron, for reasons thoroughly understood and appreciated in the iron and steel trades, that it is vastly easier today to get products made of steel than of iron. The consumer who now desires finished iron and feels that he must have it will be able to get it but it will cost more because it is more difficult to make and cannot be produced on such a large scale as steel. The man who is driven out of business by the tariff will have to find something more inviting than the Harper's Weekly editor has discovered.

The Ideal Electric & Mfg. Company, Mansfield, Ohio, has taken over the Mansfield Foundry, which will hereafter be known as the Ideal Foundry, and will be operated in connection with the Ideal Company's plant.

March Iron and Steel Exports and Imports

The report of the Bureau of Foreign and Domestic Commerce for March shows an increase, both in point of value and tonnage, in our iron and steel exports and imports as compared with the figures for February. The total value of the exports of iron and steel and manufactures thereof, not including iron ore, in March was $27,201,197, against $24,085,871 in February, and also exceeds any month of the current fiscal year. The value of similar imports in March was $3,020,482, against $2,581,379 in February. At the present time the exports of iron and steel and manufactures thereof are at the rate of over 3,000,000 tons per year as compared with an actual business of 2,509,744 tons for the fiscal year ended June 30, 1912. If the present rate and value of exports should be continued throughout the remaining three months of the current fiscal year, the value of such exports would be approximately 12 per cent. greater than the record figure of $268,154,262 for 1912.

The exports of commodities for which quantities are given total 257,321 gross tons in March, against 241,880 tons in February. Among the noteworthy changes in the exports are the trebling of the quantities of bar iron and hoops and bands for the month as compared with a year ago and a decrease of 50 per cent. in the amount of cut nails, both for the month of March and for the nine months. The quantity of wire nails exported in March was practically double that for 1912 and of all other nails including tacks was only about one-third as large as the corresponding periods a year ago. Details of the exports of such commodities for March and nine months of the current fiscal year ended with March, compared with the corresponding periods of the previous fiscal year, are as follows:

Exports of Iron and Steel

	March		Nine months	
Commodities	1913 Gross tons	1912 Gross tons	1913 Gross tons	1912 Gross tons
Pig iron	28,711	19,689	223,020	100,805
Scrap	10,582	6,915	81,714	57,107
Bar iron	2,180	701	19,752	10,365
Wire rods	9,320	7,859	53,000	29,063
Steel bars	20,224	15,495	179,963	98,365
Billets, ingots and blooms, n. e. s.	16,650	23,782	206,604	150,410
*Bolts and nuts	1,842	.....	15,181	.....
Hoops and bands	2,529	740	13,810	5,565
*Horse shoes	142	.....	882	.....
Cut nails	354	825	3,995	7,971
§Railroad spikes	980	.....	9,725	.....
Wire nails	5,520	2,964	44,346	42,359
All other nails, including tacks	430	1,181	3,159	9,576
Pipes and pipe fittings	29,493	26,667	190,594	159,324
Radiators and cast-iron house heating boilers	533	384	6,473	3,362
Steel rails	25,371	27,332	335,362	273,033
§Galvanized iron sheets and plates	7,252	13,382	95,541	125,635
§All other iron sheets and plates	3,026		25,128	
§Steel plates	21,817	26,286	194,904	190,351
§Steel sheets	11,084		96,222	
Structural iron and steel	32,065	19,853	246,155	174,100
Tin and terne plates	9,164	5,950	54,515	50,758
Barbed wire	7,041	6,789	67,571	77,759
All other wire	11,011	11,424	105,390	95,630
Totals	257,321	218,218	2,273,006	1,661,538

*Included in all "other manufactures of iron and steel" prior to July 1, 1912.
§Not separately stated prior to July 1, 1912.

In March the imports of commodities for which quantities are given totaled 27,247 gross tons, against 24,903 tons in February. Details of the imports of such commodities for March and for nine months of the current fiscal year ended with March, compared with the corresponding periods of the previous fiscal year, are as follows:

Imports of Iron and Steel

	March		Nine months	
Commodities	1913 Gross tons	1912 Gross tons	1913 Gross tons	1912 Gross tons
Pig iron	15,628	10,154	113,526	88,237
Scrap	3,844	690	28,741	8,431
Bar iron	2,674	1,150	21,744	17,260
Structural iron and steel	392	416	4,343	2,461
Billets, bars and steel plates, n. e. s.	2,143	1,502	14,692	17,611
Steel rails	467	328	2,921	2,621
Sheets and plates	348	121	2,858	1,735
Tin and terne plates	200	106	1,790	2,562
Wire rods	1,551	1,039	11,434	10,521
Totals	27,247	15,466	202,049	151,439

The importations of iron ore in March were 164,865 gross tons, against 188,734 tons in February and 157,469 tons in February, 1912. The total quantity of iron ore imported in nine months of the current fiscal year ended with March was 1,639,262 gross tons, against 1,451,144 tons in the corresponding period of the previous fiscal year. The exports of iron ore for the month of March were 3610 gross tons as compared with 293 tons the previous year.

The total value of the exports of iron and steel and manufactures thereof, excluding ore, in the nine months of the current fiscal year ended with March was $225,515,424, against $182,289,715 in the corresponding period of the previous fiscal year. The total value of similar imports was $24,307,884 and $19,551,723, respectively.

The Buffalo Machinists' Strike

Likely to Reach a Point of Satisfactory Adjustment Soon

The president of the Employers' Association of Buffalo, William H. Barr, general manager of the Lumen Bearing Company, stated to a representative of *The Iron Age* that less than 1000 machinists struck, although the strike threw out of employment a total of about 3000 men, including helpers and laborers. Employers in practically every instance closed their shops when the machinists went out. Nineteen shops in all were thus closed, the following being a list:

Crosby Company, Buffalo Gasoline Motor Company, H. G. Trout Company, Niagara Machine & Tool Works, John E. Smith's Sons Company, D. H. Stoll Company, Sterling Engine Company, McCue Company, Contractors' Plant Mfg. Company, Automatic Transportation Company, Augustine Automatic Rotary Engine Company, Linde Air Products Company, Olin Gas Engine Company, Ford Motor Company, Buffalo Pitts Company, King Sewing Machine Company, Ericsson Mfg. Company, Taber Pump Company and Buffalo Forge Company. All but the last named are members of the Employers' Association.

At the Buffalo Pitts Company's plant only a few of the younger men went out and nearly all were back again within two days. At the Snow Steam Pump Works (a subsidiary of the International Steam Pump Company), one of the largest shops in the city, the men did not go out. The manager, A. Niedermeyer, states that because of that fact the company had decided to make the working hours 54 per week, or on the same time basis as the majority of the machine shops in Buffalo, and to advance wages slightly to compensate for the reduction in hours, the factory to remain an open shop as in the past. The men employed by the Otis Elevator Company returned to work last Friday after a satisfactory agreement with the officials of the company had been reached. The men in four other shops returned Monday morning, May 26. These include the works of H. G. Trout Company, manufacturer of machinery; John E. Smith's Sons Company, manufacturer of butchers' tools, and Crosby Company, manufacturer of sheet metal goods.

The Crosby Company employs 800 men, 150 of whom are machinists and specialists, 400 are pressmen and the remainder welders, helpers and laborers. President Crosby of that company states that the men returned under the conditions existing when they quit May 12 and which had been in effect since September last, namely, a 55-hr. week with full 60-hr. pay, with the further agreement that any grievances in any department shall be adjusted as rapidly as possible and all advances in wages which may be given will date from the reopening of the plant, May 26. This arrangement was reached after conferences with the company's employees only, no others being present except Mr. Downey, the State mediator, who called to hear the company's side of the case. The open shop is to be maintained as in the past. The 100 employees, including 40 machinists, of the plant of the Charles E. Hall Company, manufacturer of mechanics' tools, also returned to work on Monday on the same conditions as existed prior to the strike, with similar agreement as that made by the Crosby Company.

President Barr of the Employers' Association states that that organization, which is an exceedingly strong one, has always maintained the open-shop policy and will continue to do so and will fight to a finish the demand of the machinists for recognition of the union and for a 50-hr. week. It will stand firmly for the 54-hr. basis as the minimum for a week's work and for the open shop, its attitude being that it will treat with its own employees direct without the medium of the union and accord fair treatment and act with them to correct any injustice, it being immaterial as to whether or not the employees are members of a union, which is their privilege.

Mr. Barr further stated that the Employers' Association comprises all the leading foundries, machine shops, boiler shops, wood-working plants, and employing tinsmiths of the city, also the lithographers and printers and the employing commercial teamsters, controlling 75 to 80 per cent. of the public teamsters of the city. The open-shop conditions which have been maintained in Buffalo for the past 10 years have very largely been due to the attitude of this association. It successfully fought the teamsters' strike in 1901, the iron molders' strike in 1906, and the wood workers' strike in 1911. It conducts a labor employment bureau free of charge to the men and endeavors to promote the welfare and efficiency of the employees of its members and see that modern and sanitary shop conditions are provided.

Joseph Sonnabend, national organizer of the Machinists' Union, says: "There is no weakening on the part of the men. Where they are returning to work they have gained what they asked. That is the only condition under which they will return. In the shops where hearing have been refused by the owners the men are still out and will continue to stay out."

Mr. Hill, of the Charles E. Hall Company, states that it is probable that a great many of the men who have come back to work have affiliated with the union but are returning under open-shop requirements and conditions insisted upon by the employers.

The Senate Finance Committee and the Tariff

WASHINGTON, D. C., May 27.—The action of the majority, or Democratic, members of the Finance Committee in formulating a series of questions to manufacturers who have filed briefs with the Democratic subcommittees, or whose representatives have been heard orally, to be answered under oath, is looked upon here as either a blunder or a deliberate intention to insult and discredit those who have protested against the Underwood tariff bill. Taken in connection with the announced policy of the Administration to investigate manufacturers who may be compelled to reduce wages on account of the provisions of the bill, it is looked upon as spelling for the Democratic majority in the House and Senate and the Administration generally considerable trouble.

The circular gotten out by the majority members of the Finance Committee is headed, "Interrogatories Propounded to Manufacturers," and its distribution began yesterday. The imputation carried is plainly that those who have been heard so far have misrepresented conditions, and already Republican Senators are voicing their protests against the circular. Incidentally, the circular carries no assurance that the answers to be filed will be given serious consideration. The opinion is expressed here that a manufacturer endeavoring to answer the questions fully and completely would have to be assisted by a corps of trained experts and a comprehensive reference library. The circular also contains a list of questions formulated by Senator La Follette, presented, however, before any testimony or briefs had been received by the Democratic subcommittees.

Senator Stone, who is chairman of the Democratic subcommittee considering the metal schedule, intimates that the subcommittee will report in favor of placing pig iron and ferromanganese on the free list. W. L. C.

Fred C. Deming, manager of sales of the Carnegie Steel Company at Buffalo, who is chairman of the Entertainment Committee for the annual convention of the American Iron, Steel and Heavy Hardware Association, to be held in Buffalo, June 10, 11 and 12, advises that an elaborate programme of entertainment has been provided for the members, visitors and ladies, comprising steamboat rides, visit to Niagara Falls, luncheons, automobile trips around the city, etc. On the evening of Thursday, June 12, a complimentary banquet at the Hotel Statler will be tendered to the jobbers of the association by the manufacturing members.

The Iron and Metal Markets

Better Railroad Buying

Foundry Iron 25 to 50 Cents Lower

Advance in Merchant and Line Pipe—Irregularity in Sheet Prices

In the midst of reports generally dwelling on the low rate of new buying in rolled products encouragement is taken in some quarters from the railroad demand of the past week. Car orders from the Erie, Chesapeake & Ohio and Lehigh Valley roads make a total of 10,000. Locomotive orders, including 179 for the New York Central, have also been a factor.

Our Chicago report calls attention to the railroad specifications there, which have been on a larger scale than for some time. In track fastenings, counting in current orders, there were 30,000 kegs. In the East, bridge work on which the B. & O., Norfolk & Western and New York Central will take bids amounts to about 6500 tons and the Lackawanna has let a contract for 2200 tons.

Apart from railroad buying, however, current demand is not important, though it should be said that some of the steel companies have found reasons in the past fortnight for rather brighter forecasts. There have been occasional reports of cancellations in bars and they are verified to this extent: Two mills have been getting business with the promise of 30-day deliveries. A few buyers, chiefly jobbers, have placed such early delivery orders and have made corresponding reductions in the total of their specifications with other mills. Cutting of bar iron prices is still indicated in Western districts.

The one definite change in finished material prices is an advance of about $1 a ton in steel merchant pipe and line pipe. The last similar advance, made on April 12, was designed as an antidote for the cutting that had then prevailed for some time. In the wire trade a like expedient had been resorted to, but wire manufacturers still have the price problem with them in view of the slow movement of their products.

Prices of plates and structural steel, as with those for steel bars, are maintained on contract business, but earlier deliveries are possible in plates and shapes, particularly the latter. Fabricators are competing so keenly that premiums on plain material are practically wiped out on some early deliveries.

With all the cutting on fabricating contracts, the prospect for structural work is good. On the first of the New York Subway contracts—Broadway section No. 4—requiring about 4300 tons of steel, bids will be opened June 24. At Pittsburgh the proposed hotel at Smithfield street and Sixth avenue, will require 8000 to 10,000 tons.

The condition of the sheet market was the subject of conferences of manufacturers at Pittsburgh May 22 and 27. Cutting of the 2.35c. basis for No. 28 black sheets had amounted to $2 a ton, but 2.30c. is now commonly the minimum.

The expected additions to open-hearth steel capacity are having their effect on the sheet bar market. Sales are reported at $27, Pittsburgh, for June and later delivery. One contract for the second half, 4000 to 4500 tons, was made at $27.50, Youngstown. An Ohio sheet mill has been inquiring for 1000 to 2000 tons a month over a period of two years.

Foundry iron has declined 25 to 50 cents in the past week, as low as $11.25, Birmingham basis, being reported for Southern No. 2 from a Tennessee furnace. Eastern sales have been made indicating a $14.50 Buffalo price for No. 2 X. At Pittsburgh $14 for No. 2 iron at Valley furnace was bid on a large inquiry still pending. The high rate of consumption of foundry iron in conjunction with present low prices is attracting attention, as is the fact of the large number of buyers who are waiting for the low point. The buying movement is not yet here, but there are a few signs of closely impending contracts. Several furnaces have gone out because of the low state of the market.

The market for Bessemer iron at $16.60 and for basic at $14.75 Valley furnace is drooping and inactive.

Buying of heavy melting steel by important interests at Pittsburgh is the sole feature in a very weak and unpromising scrap market.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type. Declines in Italics

At date, one week, one month, and one year previous.

	May 28, 1913.	May 21, 1913.	Apr. 30, 1913.	May 29, 1912.
Pig Iron, Per Gross Ton:				
Foundry No. 2 X, Philadelphia	*$16.50*	$16.75	$17.00	$15.25
Foundry No. 2, Valley furnace	14.50	14.50	15.00	13.25
Foundry No. 2 S'th'n, Cin'ti..	14.75	14.75	15.25	14.25
Foundry No. 2, Birmingham, Ala.	11.50	11.50	12.00	11.00
Foundry No. 2, furnace, Chicago*	16.00	16.00	16.75	14.50
Basic, delivered, eastern Pa....	16.50	16.50	16.50	15.25
Basic, Valley furnace.....	*14.75*	15.00	15.75	13.00
Bessemer, Pittsburgh	17.50	17.50	17.90	15.15
Malleable Bessemer, Chicago*..	16.00	16.00	16.75	14.50
Gray forge, Pittsburgh.....	*14.90*	15.00	15.40	13.90
Lake Superior charcoal, Chicago	18.00	18.00	18.00	15.75
Billets, etc. Per Gross Ton:				
Bessemer billets, Pittsburgh...	*26.50*	27.00	28.50	21.00
Open-hearth billets, Pittsburgh.	*26.50*	27.00	29.00	20.50
Forging billets, Pittsburgh.....	34.00	34.00	36.00	28.00
Open-hearth billets, Philadelphia	28.00	28.00	29.00	23.40
Wire rods, Pittsburgh	30.00	30.00	30.00	25.00
Old Material, Per Gross Ton:				
Iron rails, Chicago.....	15.75	15.75	16.00	16.00
Iron rails, Philadelphia.....	18.00	18.00	18.00	16.50
Carwheels, Chicago	14.25	14.25	16.75	14.00
Carwheels, Philadelphia	13.50	13.50	14.25	13.50
Heavy steel scrap, Pittsburgh..	*13.00*	13.50	14.00	13.25
Heavy steel scrap, Chicago.....	*10.50*	10.75	12.00	12.00
Heavy steel scrap, Philadelphia	*11.50*	12.00	12.50	13.50
Finished Iron and Steel, Per Pound to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bessemer rails, heavy, at mill...	1.25	1.25	1.25	1.25
Iron bars, Philadelphia	1.57½	1.57½	1.57½	1.30
Iron bars, Pittsburgh	1.70	1.70	1.70	1.25
Iron bars, Chicago	1.57½	1.57½	1.57½	1.25
Steel bars, Pittsburgh, future..	1.40	1.40	1.40	1.20
Steel bars, Pittsburgh, prompt..	1.70	1.70	1.80	1.20
Steel bars, New York, future..	1.56	1.56	1.56	1.36
Steel bars, New York, prompt..	1.86	1.86	1.96	1.36
Tank plates, Pittsburgh, future.	1.45	1.45	1.45	1.25
Tank plates, Pittsburgh, prompt	1.60	1.60	1.60	1.25
Tank plates, New York, future	1.61	1.61	1.61	1.41
Tank plates, New York, prompt	1.76	1.76	1.76	1.41
Beams, Pittsburgh, future.....	1.45	1.45	1.45	1.25
Beams, Pittsburgh, prompt.....	1.50	1.50	1.60	1.25
Beams, New York, future.....	1.61	1.61	1.61	1.41
Beams, New York, prompt.....	1.66	1.66	1.71	1.41
Angles, Pittsburgh, future.....	1.45	1.45	1.45	1.25
Angles, Pittsburgh, prompt.....	1.50	1.50	1.60	1.25
Angles, New York, future.....	1.61	1.61	1.61	1.41
Angles, New York, prompt....	1.66	1.66	1.71	1.41
Skelp, grooved steel, Pittsburgh.	1.45	1.45	1.45	1.15
Skelp, sheared steel, Pittsburgh.	1.50	1.50	1.50	1.20
Steel hoops, Pittsburgh	1.60	1.60	1.60	1.25

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Sheets, Nails and Wire, Per Pound to Large Buyers:	May 28, 1913. Cents.	May 21, 1913. Cents.	Apr. 30, 1913. Cents.	May 29, 1912. Cents.
Sheets, black, No. 28, Pittsburgh	2.30	2.30	2.35	1.90
Wire nails, Pittsburgh	1.80	1.80	1.80	1.60
Cut nails, f.o.b. Eastern mills	1.80	1.80	1.80	...
Cut nails, Pittsburgh	1.70	1.70	1.70	1.55
Fence wire, ann'l'd, 0 to 9, Pgh.	1.60	1.60	1.60	1.40
Barb wire, galv., Pittsburgh	2.20	2.20	2.20	1.90
Coke, Connellsville, Per Net Ton, at Oven:				
Furnace coke, prompt shipment	$2.15	$2.15	$2.00	$2.10
Furnace coke, future delivery	2.25	2.25	2.25	2.35
Foundry coke, prompt shipment	**2.85**	2.75	3.00	2.50
Foundry coke, future delivery	3.00	3.00	3.00	2.50
Metals, Per Pound to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York	15.75	16.00	15.75	16.75
Electrolytic copper, New York	15.65	15.75	15.62½	16.62½
Spelter, St. Louis	5.25	5.30	5.45	6.75
Spelter, New York	5.40	5.45	5.60	6.90
Lead, St. Louis	4.20	4.20	4.37½	4.12½
Lead, New York	4.35	4.35	4.50	4.20
Tin, New York	**48.75**	48.25	49.87½	46.00
Antimony, Hallett, New York	8.20	8.25	8.12½	7.62½
Tin plate, 100-lb. box, Pittsburgh	$3.60	$3.60	$3.60	$3.40

Finished Iron and Steel f. o. b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16c.; Philadelphia, 15c.; Boston, 18c.; Buffalo, 11c.; Cleveland, 10c.; Cincinnati, 15c.; Indianapolis, 17c.; Chicago, 18c.; St. Louis, 22½c.; Kansas City, 42½c.; Omaha, 42½c.; St. Paul, 32c.; Denver, 84½c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 80c. on plates, structural shapes and sheets No. 11 and heavier; 85c. on sheets Nos. 12 to 16; 95c. on sheets No. 16 and lighter; 65c. on wrought pipe and boiler tubes.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 1.45c. to 1.50c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers, with extras:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated February 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft., are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge, or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft., down to the weight of 3-16 in., take the price of 3-16 in.

Allowable overweight, whether plates are ordered to gauge or weight, to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras.	Cents per lb.
Gauges under ¼ in. to and including 3-16 in.	.10
Gauges under 3-16 in. to and including No. 2	.15
Gauges under No. 8 to and including No. 9	.25
Gauges under No. 9 to and including No. 10	.30
Gauges under No. 10 to and including No. 12	.40
Sketches (including straight taper plates) 3 ft. and over	.10
Complete circles, 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive firebox steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in.	1.00
Cutting to lengths, under 3 ft., to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft., to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting rectangular plates to lengths 3 ft. and over.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees, 3 in. and over, 1.45c. to 1.50c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in. on one or both legs	.10
Angles, 3 in. on one or both legs, less than ¼ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, hand rail, car-truck and conductor rail)	.05
Angles, channels and tees, under 3 in. wide as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Hand rail tees	.75
Cutting to lengths, under 3 ft., to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft., to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Wire Rods and Wire.—Bessemer, open-hearth and chain rods, $30. Fence wire, Nos. 0 to 9, per 100 lb., terms 60 days or 2 per cent. discount in 10 days, carload lots to jobbers, annealed, $1.60; galvanized, $2. Galvanized barb wire, to jobbers, $2.20; painted, $1.80. Wire nails, to jobbers, $1.80.

The following table gives the price to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.

Nos.	0 to 9	10	11	12 & 12½	13	14	15	16
Annealed	$1.75	$1.80	$1.85	$1.90	$2.00	$2.10	$2.20	$2.30
Galvanized	2.15	2.20	2.25	2.30	2.40	2.50	2.90	3.00

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card on steel pipe (full weight) in effect from May 27, 1913, iron pipe (full weight), from October 21, 1912:

Butt Weld.

Steel. Inches.	Black.	Galv.	Iron. Inches.	Black.	Galv.
⅛, ¼ and ⅜	72	52	⅛ and ¼	67	48
½	76	66	⅜	66	47
¾ to 3	79	71	½	70	57
			¾ to 2½	73	62

Lap Weld.

2	76	68	1¼	57	46
2½ to 6	78	70	1½	68	57
7 to 12	75	65	2	69	59
13 to 15	52	..	2½ to 4	71	62
			4½ to 6	71	62
			7 to 12	69	56

Plugged and Reamed.

1 to 3, butt	77	69	1 to 1½, butt	71	60
2, lap	74	66	2, butt	72	61
2½ to 4, lap	76	68	1¼, lap	55	44
			1½, lap	66	55
			2, lap	67	57
			2½ to 4, lap	69	60

Butt Weld, extra strong, plain ends.

⅛, ¼ and ⅜	67	57	⅜	64	53
½	72	66	½	68	61
¾ to 1½	76	70	¾ to 1½	72	63
2 to 3	77	71	2 and 2½	73	64

Lap Weld, extra strong, plain ends

2	73	65	1½	66	60
2½ to 4	75	67	2	67	59
4½ to 6	74	66	2½ to 4	71	62
7 to 8	67	57	4½ to 6	70	61
9 to 12	62	52	7 and 8	64	54
			9 to 12	59	48

Butt Weld, double extra strong, plain ends.

½	62	56	½	58	50
¾ to 1½	65	59	¾ to 1½	61	53
2 to 2½	67	61	2 and 2½	63	55

Lap Weld, double extra strong, plain ends.

2	63	57	2	56	50
2½ to 4	65	59	2½ to 4	61	55
4½ to 6	64	58	4½ to 6	60	54
7 to 8	57	47	7 to 8	53	43

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Boiler Tubes.—Discounts to jobbers, in carloads on lap-welded steel, in effect from February 1, 1913, and standard charcoal-iron boiler tubes, in effect from January 1, 1913, are as follows:

Lap-Welded Steel.		*Standard Charcoal Iron.*	
1¾ and 2 in.	60	1½ in.	44
2¼ in.	57	1¾ and 2 in.	48
2½ and 2¾ in.	63	2¼ in.	44
3 and 3¼ in.	68	2½ and 2¾ in.	53
3½ to 4½ in.	70	3 and 3¼ in.	55
5 and 6 in.	63	3½ to 4½ in.	58
7 to 13 in.	60		

Locomotive and steamship special grades bring higher prices.

2½ in. and smaller, over 18 ft., 10 per cent. net extra.
2¼ in. and larger, over 22 ft., 10 per cent. net extra.

Less than carloads will be sold at the delivered discounts for carloads, lowered by two points for lengths 22 ft. and under to destinations east of the Mississippi River; lengths over 22 ft. and all shipments going west of the Mississippi River must be sold f.o.b. mill at Pittsburgh basing discount, lowered by two points.

Sheets.—Makers' prices for mill shipments on sheets of U. S. Standard gauge, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms 30 days net or 2 per cent. cash discount in 10 days from date of invoice:

Blue Annealed Sheets.

	Cents per lb.
Nos. 3 to 8	1.70
Nos. 9 and 10	1.75
Nos. 11 and 12	1.80
Nos. 13 and 14	1.85
Nos. 15 and 16	1.95

Box Annealed Sheets, Cold Rolled.

Nos. 10 and 11	1.95 to 2.00
No. 12	1.95 to 2.00
Nos. 13 and 14	2.00 to 2.05
Nos. 15 and 16	2.05 to 2.10
Nos. 17 to 21	2.10 to 2.15
Nos. 22 and 24	2.15 to 2.20
No. 25 and 26	2.20 to 2.25
No. 27	2.25 to 2.30
No. 28	2.30 to 2.35
No. 29	2.35 to 2.40
No. 30	2.45 to 2.50

Galvanized Sheets of Black Sheet Gauge.

	Cents per lb.
Nos. 10 and 11	2.40 to 2.50
No. 12	2.50 to 2.60
Nos. 13 and 14	2.50 to 2.60
Nos. 15 and 16	2.65 to 2.75
Nos. 17 to 21	2.80 to 2.90
Nos. 22 and 24	2.95 to 3.05
Nos. 25 and 26	3.10 to 3.20
No. 27	3.25 to 3.35
No. 28	3.40 to 3.50
No. 29	3.55 to 3.65
No. 30	3.70 to 3.80

Pittsburgh

PITTSBURGH, PA., May 27, 1913.

Three or four of the larger steel interests continue to report that specifications are coming in at the rate of 75 to 85 per cent. of shipments or an average of about 80 per cent. With actual orders on the books of the steel mills to take their output for at least the next three months, it would be well into the fourth quarter before they would be entirely caught up on deliveries if no more orders were placed. However, new orders are coming in and while they are not heavy several interests report that they have booked more new orders in the past week than in any like period for some time, and the general feeling in the trade is more optimistic. Some surprising figures are being given out by James J. Hill and other authorities as to prospects for crops this year. These, if realized, would mean great activity among the railroads when these enormous crops commence to move. Heavy orders for locomotives placed in the past week by several leading roads, together with some contracts for cars, have helped along the better feeling. Prices on nearly all finished iron and steel products are firm and the leading pipe interest has just announced an advance of half a point, or $1 a ton, in merchant steel and line pipe. The sheet market is on a better basis as a result of a closer understanding among the mills, and some low prices recently put out have been withdrawn. The wire market continues dull and the scrap trade seems to be pretty badly demoralized. Heavy steel melting scrap, which is regarded worth as much as basic pig iron, has sold at $13, delivered at buyer's works. The weak spot in raw materials is pig iron, and while there is very little new business, some low figures have been made on the few inquiries that are out. Labor matters in the Pittsburgh district are looking better, the troubles at the works of the Pressed Steel Car Company and the Superior Steel Company having been amicably settled. There is no doubt that a great deal of new business is being held up pending tariff legislation.

Pig Iron.—The inquiry of the Westinghouse Electric & Mfg. Company for its last half iron for its East Pittsburgh and Cleveland, Ohio, works has not been closed. It is understood that on the iron for East Pittsburgh one furnace, which has a freight rate of 75 cents, has made a price on the No. 2 iron of $14.75, delivered, while a Cleveland interest having only a switching charge to the Cleveland works has made a relatively low delivered price. The Westinghouse Machine Company has an inquiry out for its requirements of foundry iron for last quarter, and some low prices have gone in, but the business may not be closed for some little time. A local steel casting company has an inquiry out for 500 tons of basic iron for June delivery and has asked that all prices be submitted prior to June 1. Three or four local consumers of basic iron are said to be in need of June iron and their inquiries are expected at any time. The very low prices ruling for scrap are having a sympathetic effect on pig iron and indications favor a lower market on basic and foundry and probably also on Bessemer. There has not been a transaction in Bessemer iron in this market and there is no new inquiry. Small foundries are buying No. 2 foundry iron in lots of 100 tons and more at about $14.50, Valley furnace. We quote Bessemer iron at $16.60; basic, $15; malleable Bessemer, $14.75; No. 2 foundry, $14.50; gray forge, $14 to $14.25, all at Valley furnace, the freight rate to the Pittsburgh district being 90c. a ton.

Billets and Sheet Bars.—The local market is quiet as regards new sales and inquiry, but prices are fairly strong. A leading sheet mill bought 4000 to 4500 tons of sheet bars for third and fourth quarter delivery on the basis of $27.50 Youngstown mill. Most consumers are covered during third quarter and deliveries by the outside mills to sheet and tin plate works are more satisfactory than for some time. We continue to quote Bessemer and open-hearth billets for June shipment, and also for third quarter delivery, at $26.50 to $27 and Bessemer and open-hearth sheet bars for same deliveries at $27 to $27.50, maker's mill, Youngstown or Pittsburgh. We quote forging billets $34 to $35 and axle billets $33 to $34, Pittsburgh.

Ferroalloys.—An inquiry is out for 500 tons of ferromanganese for delivery in second half, but it is believed the prospective buyer is only feeling out the market. An occasional carload for prompt shipment is being sold at $60 to $60.50, Baltimore. Carload lots of ferrosilicon are being sold right along at the full price of $75 delivered in the Pittsburgh district. We quote 80 per cent. English ferromanganese for prompt shipment at $60 to $60.50 and for forward delivery at $61, Baltimore, with a freight rate to the Pittsburgh district of $2.16 per ton. We quote 50 per cent. ferrosilicon, in lots up to 100 tons, at $75; over 100 tons to 600 tons, $74; over 600 tons, $73, Pittsburgh. We quote 10 per cent. at $24; 11 per cent., $25; 12 per cent., $26, f.o.b. cars at furnace, Jackson, Ohio, or Ashland, Ky. We quote ferro-carbon-titanium at 8c. per lb. in carloads; 10c. in 2000-lb. lots and over, 12½c. in lots up to 2000 lb.

Wire Rods.—There is little new demand and specifications against contracts are only fair. We continue to quote Bessemer, open hearth and chain rods at nominally $30, Pittsburgh, but if any new business were offering, a lower price would be made.

Muck Bar.—The scarcity of puddlers is interfering materially with output of muck bar, and as consumption is rather heavy at present, the market is firmer. We quote standard grades of local bar, made from all pig iron, at about $31, Pittsburgh.

Skelp.—New demand is dull, but skelp mills are pretty well filled up over the next two or three months. We quote: Grooved skelp, 1.45c. to 1.50c.; sheared steel skelp, 1.50c. to 1.55c.; grooved iron skelp, 1.75c. to 1.80c.; sheared iron skelp, 1.85c. to 1.90c., delivered at buyer's mill in the Pittsburgh district.

Steel Rails.—Current orders for standard sections, ranging from 100 tons up to 400 and 500 tons are being placed right along, but no large contracts are being taken by the local interest. The new demand for light rails is dull, the Carnegie Steel Company having taken new orders and specifications in the past week for about 2500 tons. We quote splice bars at 1.50c. per lb. and standard section rails at 1.25c. per lb. Light rails are quoted as follows: 25, 30, 35, 40 and 45 lb. sections, 1.25c.; 16 and 20 lb., 1.30c.; 12 and 14 lb., 1.35c., and 8 and 10 lb., 1.40c., all in carload lots, f.o.b. Pittsburgh.

Structural Material—Definite plans have been made by interests connected with the Fort Pitt Hotel, this city, for building a large hotel at Smithfield street and Sixth avenue, work to commence in a short time. Present plans will mean that 8000 to 10,000 tons of steel will be needed. The Jones & Laughlin Steel Company is the low bidder on 1800 tons of structural shapes for the two new Government colliers, but has not yet been awarded the contract. The American Bridge Company has taken 2500 tons for the Pantlind Hotel in Grand Rapids, Mich., and bids have gone in on about 3000 tons of bridge work for the Baltimore & Ohio Railroad in the Pittsburgh district. Local fabricating shops are well filled up over the next four or five months, but complaint is made that new work is going at relatively low prices. We quote beams and channels up to 15 in. at 1.45c. to 1.50c. Small lots from warehouse for prompt delivery are bringing from 1.60c. up, depending on the size of the order and the deliveries wanted.

Plates.—Last week the Erie Railroad placed 5000 cars, of which the American Car & Foundry Company took 1500, the Standard Steel Car Company 1500 box, 500 gondola and 500 steel hopper cars and the Pressed Steel Car Company 1000 steel hoppers. The Chesapeake & Ohio ordered from the Standard Steel Car Company 2000 70-ton hopper cars of heavy design, each requiring 14 to 15 tons of plates and shapes. Not many car inquiries are out, the aggregate being put at about 5000. The Carnegie Steel Company has received through the United States Steel Products Company an order for 5000 tons of plates and shapes for the new Canadian boat to be built by the American Shipbuilding Company at its Port Arthur works. The Seattle Construction & Dry Dock Company, Seattle, Wash., is the low bidder on a submarine tender to be built by the Government, which will require 2000 to 3000 tons of plates. Local plate mills are filled up for the next two or three months, but outside mills are offering plates for delivery in three to four weeks from date of order at 1.50c. to 1.60c., delivered in the Pitts-

burgh district. For ¼-in. and heavier tank plates we quote 1.45c., Pittsburgh, for forward delivery.

Iron and **Steel Bars.**—Some additional contracts for steel bars from implement makers have been placed in the past week for delivery over second half of the year and in some cases running into first half of next year. New demand for steel bars is reported to be a little more active and specifications are still fairly heavy. It is stated that shipments by the mills are now probably about 20 per cent. in excess of specifications. The larger makers of steel bars have orders on their books to take their entire output over the next three months or longer. The new demand for iron bars has quieted down and specifications against contracts are less active. Prices on merchant steel bars are very firm and 1.40c. at mill for forward delivery is being rigidly held. We quote iron bars at 1.70c. to 1.75c. for reasonably prompt delivery. Mills charge $1 extra per ton for twisting ¾ in. and larger steel bars and $2 extra for ½ to ⅝ in.

Sheets.—A conference of a number of leading makers of steel sheets was held on Thursday, May 22, and another is being held to-day (Tuesday). As a result it is stated that some low prices recently put out by some of the sheet mills have been withdrawn, and the market is on a better basis than for some time. The minimum on No. 28 black sheets is now regarded as 2.30c. at mill, and a number of leading makers are reported as holding firm at 2.35c. at mill. It is said a few mills are still naming 3.40c. on galvanized, but others are holding at 3.50c. Specifications against contracts for sheets continue heavy and new demand has picked up somewhat in the past week. A number of consumers that were offered contracts for sheets at relatively low prices two or three weeks ago and did not accept them now regret their action, as the market is stronger. We quote No. 10 blue annealed sheets at 1.75c.; No. 28 Bessemer black sheets, 2.30c. to 2.35c.; No. 28 galvanized at 3.40c. to 3.50c., and No. 28 tin mill black plate at 2.30c. These prices are f.o.b. Pittsburgh, in carload and larger lots, jobbers charging the usual advances for small lots from store.

Tin Plate.—New specifications against contracts for tin plate are lighter than anticipated, and unless there is soon some improvement, it is possible a slowing down in operations among some of the tin plate mills may soon be necessary. It is stated that the canning interests carried over a fairly large supply of cans from last year, and as a result are not specifying against their contracts as freely as otherwise would be the case. Several leading makers of tin plate report they have actual specifications on their books taking the greater part of their output up to October or later, but this condition is the exception. The supply of steel is slightly better, and tin plate mills which buy bars in the open market report they are getting more satisfactory deliveries than for some time. This week the American Sheet & Tin Plate Company is operating close to 90 per cent., but other mills getting a full supply of steel are running full. The entire plant of the Phillips Sheet & Tin Plate Company at Weirton, W. Va., containing 20 hot tin mills which closed down some time ago on account of an accident to the power house, is again in full operation. No new orders for tin plate are being placed as consumers are covered. We quote 100 lb. cokes at $3.60; 100 lb. ternes at $3.45 and No. 28 black plate for tinning purposes at $2.30, all f.o.b., Pittsburgh.

Wire Products.—Conditions in the wire trade are unsatisfactory, new demand being dull, and specifications against contracts coming in at only a fair rate. The jobbing trade is specifying only for such quantities of nails and wire as are needed to maintain a full assortment of sizes in stock, and are not disposed to anticipate. Shipments by the wire and wire nail mills show a falling off this month as compared with April. The price of $1.80 on wire nails and $1.60 on annealed wire has not been maintained since being put in force. Regular prices, which are shaded about $1 a ton, are as follows: Wire nails, $1.80, base, per keg; cut nails, $1.70 to $1.75; galvanized barb wire, $2.20 per 100 lb.; painted, $1.80; annealed fence wire, $1.60, and galvanized fence wire, $2, f.o.b. Pittsburgh, usual terms, freight added to point of delivery. Jobbers charge the usual advances over these prices for small lots from store.

Railroad Spikes.—Specifications from the railroads have fallen off very materially, and new demand is light. Prices on spikes are weak, and in the Chicago district there has been some cutting. It is stated that standard sizes of railroad spikes have been sold in the Chicago district as low as $1.85 per 100 lb. We quote railroad spikes in base sizes, 5½ x 9/16 in. at $1.75 to $1.80, and small railroad and boat spikes in carload and larger lots at $1.80 to $1.85 per 100 lb. f.o.b., Pittsburgh.

Bolts and Rivets.—The local situation in the bolt and rivet trade is good, makers reporting orders on books sufficient to take their entire output for 45 to 60 days and prices are reasonably firm. In the extreme West, however, there has been a slowing down in demand, with some concessions going in prices. These do not exceed $2 a ton in rivets. Regular prices on button head structural rivets are $2.20 and on cone head boiler rivets $2.30, but these are being shaded as noted above. Regular discounts on bolts are as follows, in lots of 300 lb. or over delivered within a 20c. freight radius of maker's works:

Coach and lag screws	80 and 10% off
Small carriage bolts, cut threads	75 and 5% off
Small carriage bolts, rolled threads	75 and 10% off
Large carriage bolts	70% off
Small machine bolts, cut threads	75 and 10% off
Small machine bolts, rolled threads	75, 10 and 5% off
Large machine bolts	70 and 7½% off
Machine bolts with C.P.C. and T nuts, small	75 and 5% off
Machine bolts with C.P.C. and T nuts, large	70% off
Square hot pressed nuts, blanked and tapped	$5.70 off list
Hexagon nuts	$6.30 off list
C.F.C. and R. square nuts, tapped and blank	$5.70 off list
Hexagon nuts, ⅜ and larger	$6.60 off list
Hexagon nuts smaller than ⅜	$7.20 off list
C.P. plain square nuts	$5.20 off list
C.P. plain hexagon nuts	$5.50 off list
Semi-finished hexagon nuts ⅜ and larger	85% off
Semi-finished hex. nuts smaller than ⅜	85 and 10% off
Rivets, 7/16 x 6½, smaller and shorter	75, 10 and 10% off
Rivets, metallic tinned, bulk	3½c. per lb. net extra
Rivets, tin plated, bulk	1½c. per lb. net extra
Rivets, metallic tinned, packages	70, 10 and 10% off
Standard cap screws	75, 10, 10 and 7½% off
Standard set screws	75, 10, 10 and 7½% off

Shafting.—Some weakness in prices of shafting has developed, and the regular discount of 58 per cent. off has been materially shaded. Some fairly large contracts have been placed by the implement makers and automobile builders for delivery over the last half of the year at low prices. The new demand is quiet, and specifications against contracts are only fair. Regular discounts on cold rolled shafting are 58 per cent. off in carloads and 53 per cent. in less than carloads, but these are being shaded two points or more on large lots.

Merchant Steel.—New demand has quieted down considerably, and specifications have also fallen off in volume to some extent, so that the mills are catching up on deliveries. One leading maker states that it still has orders on its books taking its entire output up to about August 1, but that new business is coming in very slowly. Prices are only fairly strong and on favorable specifications would be shaded. We quote: Iron finished tire, 1½ x ½ in. and larger, 1.40c. to 1.55c., base; under 1½ x ½ in., 1.55c. to 1.65c.; planished tire, 1.60c. to 1.70c.; channel tire, ¾ to ⅞ and 1 in., 1.90c. to 2c.; 1⅛ in. and larger, 1.80c. to 1.90c.; toe calk, 2c. to 2.10c., base; flat sleigh shoe, 1.50c. to 1.65c.; concave and convex, 1.80c. to 1.90c.; cutter shoe, tapered or bent, 2.30c. to 2.40c.; spring steel, 2c. to 2.10c.; machinery steel, smooth finish, 1.80c. to 1.85c. We quote cold-rolled strip steel as follows: Base rates for 1 in. and 1½ in. and wider, under 0.20 carbon, and No. 10 and heavier, hard temper, 3.30c.; soft, 3.55c.; coils, hard, 3.20c.; soft, 3.45c.; freight allowed. The usual differentials apply for lighter gauges and sizes.

Merchant Pipe.—Effective Tuesday, May 27, prices on merchant and line steel pipe were advanced one-half a point, or $1 a ton. The previous similar advance was made on April 12. The mills anticipate a heavy volume of business this summer, and point to the fact that prices on pipe have been very low for a long time. It is understood the other pipe mills will take similar action. The Texas Company is in the market for 130 to 140 miles of 3, 4 and 6-in. pipe for an oil line, and it is probable this business will go to a Youngstown mill. Specifications against contracts are coming in at a fair rate, but new demand is lighter than for some time. Most of the leading pipe mills have enough orders on their books to take their output over the next several months.

Boiler Tubes.—Some heavy business in locomotive tubes has lately been placed by the Baldwin Locomotive Works and the American Locomotive Company. One leading maker reports that it is sold so far ahead on boiler tubes that it is practically out of the market on new business for delivery prior to last quarter of the year. The new demand for seamless tubing is heavy, and one maker has practically its entire output sold for remainder of this year. It is stated that regular discounts on locomotive and merchant tubes are being firmly held, and some in the trade look for an advance in prices in the near future.

Coke.—The report is confirmed that the Pittsburgh Steel Company has contracted for its entire supply of coke for last half of the year. The price is reported to have been close to $2.25 at oven. The statement in this report last week that the International Harvester Company had bought 150,000 tons of furnace coke was incorrect, the purchase having been 30,000 to 40,000 tons. American Car & Foundry Company has also contracted with a local interest for its entire supply of coke for the year beginning July 1. Prices on both contracts ranged between $3 and $3.20 at oven. There are five or six inquiries for furnace coke for delivery over last half, but they are regarded more as "feelers." The coke operators are not agitating the matter, and the chances are it will be June 15 or later before much is definitely done in closing contracts for furnace coke for last half. Standard makes of furnace coke for prompt shipment are firm, and we note sales of 6000 to 8000 tons at $2.15 to $2.25 per net ton at oven. Prices on foundry coke are holding up well, and one leading maker reports having sold considerable for last half at $3.20 per net ton at oven. We quote standard grades of prompt furnace coke at $2.15 to $2.20, while $2.25 is now talked of as the price for last half. We quote standard makes of foundry coke for last half at $3 to $3.20 per net ton at oven. The Connellsville Courier reports the output of coke in the Upper and Lower Connellsville regions last week as 409,428 tons, a decrease of about 5000 tons from the previous week.

Old Material.—The leading local consumer has notified the trade that it is congested with scrap, and has asked dealers with which it has contracts to hold up shipments until June 15. On the other hand, the very low prices ruling on steel scrap are attracting some buyers. A local interest is reported to have bought 10,000 tons of high grade heavy steel scrap for open-hearth purposes, consisting of bloom and billet ends, plate shearings and other selected stock at about $13.50, delivered at buyer's mill. Another large interest, that has not been a buyer of scrap in the open market for some months, has purchased about 5000 tons of selected open-hearth steel scrap at about the same price. Ordinary grades of heavy steel scrap are being freely offered at about $13 delivered at buyers' works. We note sales of 300 to 400 tons of heavy steel scrap at $13, delivered at Sharon, and 300 tons of machine shop turnings at about $7, delivered. Predictions are that the market will go lower. Dealers are now quoting as follows, per gross ton, for delivery in the Pittsburgh and nearby districts:

Heavy steel scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen and Pittsburgh delivery	$13.00 to $13.25
No. 1 foundry cast	13.25 to 13.50
No. 2 foundry cast	12.00 to 12.25
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	9.25 to 9.50
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	14.50 to 14.75
No. 1 railroad malleable stock	12.50 to 12.75
Grate bars	9.25 to 9.50
Low phosphorus melting stock	15.50 to 15.75
Iron car axles	25.00 to 25.50
Steel car axles	18.00 to 18.25
Locomotive axles, steel	22.00 to 22.50
Locomotive axles, iron	26.50 to 27.00
No. 1 busheling scrap	12.25 to 12.50
No. 2 busheling scrap	8.00 to 8.25
Old carwheels	14.00 to 14.25
*Machine shop turnings	7.00 to 7.25
*Cast-iron borings	8.75 to 9.00
†Sheet bar crop ends	15.00 to 15.25
Old iron rails	15.00 to 15.25
No. 1 railroad wrought scrap	14.25 to 14.50
Heavy steel axle turnings	10.50 to 10.75
Stove plate	9.25 to 9.50

*These prices are f.o.b. cars at consumers' mills in the Pittsburgh district.
†Shipping point.

Chicago

CHICAGO, ILL., May 28, 1913.—(*By Telegraph.*)

From a number of sources more or less allied, appearances of improved conditions have developed, though the significance of these is not yet apparent. Railroad specifications were up to the high weekly average of 1912 and new orders, particularly for track fastenings, totaled with specifications over 30,000 kegs. In other directions producers of steel report specificatio light and shipments in excess of bookings. Competition for new business is more energetic in steel lines among those mills that can offer delivery of plates and sheets in from four to six weeks. Steel bar specifications continue heavy and reenforcing bar sales run into a considerable tonnage. Inquiry for bar iron is light but in the West the mill attitude on prices remains the same. Bookings of orders for wire products are good, but shipments are slow because of large stocks in jobbers' hands. The interesting development in pig iron is the further reduction in the price of Southern iron, $11.50 being an open quotation in this market. Scrap prices have now declined until in some instances they are as low as in 1911, with no immediate prospect of a reaction.

Pig Iron.—The closing of various gray iron castings contracts and the purchase of iron to cover are rumored, but if true the tonnage placed has not been sufficient to add any apparent strength to the market. Surface indications show a week of very few and insignificant purchases. On the few inquiries current for iron in lots of 100 to 300 tons, the quotations of Southern furnaces ranged from $11.50 to $11.75 and instances are cited of business placed at even lower figures. There seems to be no change in the local iron situation. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace and do not include a local switching charge averaging 50c. a ton:

Lake Superior charcoal, Nos. 1, 2, 3, 4	$18.00 to $18.50
Northern coke foundry, No. 1	16.75 to 17.25
Northern coke foundry, No. 2	16.00 to 16.75
Northern coke foundry, No. 3	15.50 to 16.00
Southern coke, No. 1 foundry and No. 1 soft	16.35 to 16.85
Southern coke, No. 2 foundry and No. 2 soft	15.85 to 16.35
Southern coke, No. 3	15.35 to 15.85
Southern coke, No. 4	14.85 to 15.35
Southern gray forge	14.85 to 15.35
Southern mottled	14.85 to 15.35
Malleable Bessemer	16.00 to 16.50
Standard Bessemer	19.40 to 19.90
Basic	16.00 to 16.50
Jackson Co. and Kentucky silvery, 6 per cent.	20.40
Jackson Co. and Kentucky silvery, 8 per cent.	21.40
Jackson Co. and Kentucky silvery, 10 per cent.	22.40

(By Mail)

Rails and Track Supplies.—Specifications against contracts for rails were heavier last week than for some time but new orders were scattering and of no great consequence. Together with the rail orders, the business in track fastening constituted the most important items of the week. About 30,000 kegs of spikes and bolts were ordered, of which nearly two-thirds was new business, 10,000 kegs of spikes being taken by the Great Northern Railway, to be furnished by the Illinois Steel Company. We quote standard railroad spikes at 1.90c. to 2c., base; track bolts with square nuts, 2.30c. to 2.40c., base, all in carload lots, Chicago; tie plates, $33 to $35 net ton; standard section Bessemer rails, Chicago, 1.25c., base; open-hearth, 1.34c.; light rails, 25 to 45 lb., 1.25c.; 16 to 20 lb., 1.30c.; 12 lb., 1.35c.; 8 lb., 1.40c.; angle bars, 1.50c., Chicago.

Structural Material.—The week's contracts for fabricated steel totaled less than 600 tons. The Minneapolis Steel & Machinery Company will furnish 136 tons for the Capitol building at Salt Lake City; Dorneld & Kunert, 100 tons for the First National Bank Building, at Appleton, Wis. For the Temple Israel, Chicago, the South Halsted Street Iron Works will fabricate 203 tons, and the American Bridge Company will build 138 tons of plate girders for the Chicago Great Western Railroad. For the jobs of smaller size which have been greatly in the majority among recent lettings, prices for the fabricated steel have yielded a normal profit for the various shops, and where less attractive quotations have been named as on the large contracts it has not been at a more pronounced sacrifice than is usual in securing such work. Mill deliveries for structural shapes continue to run farther into the future than most of the other lines. For Chicago delivery, mill shipment, we quote 1.63c. to 1.68c.

One of the most satisfactory phases of the market situation has been the steady demand for shapes out of store, in which there has been no material let-up. From store we quote 2.05c.

Plates.—Although the ability to deliver plates in from four to six weeks is still confined to some of the smaller mills, there is a general disposition to seek business more actively due to nothing more than the falling off in new business offering. For the earliest deliveries available there is a fair business. We quote for mill shipment, Chicago delivery, 1.63c. to 1.68c.

Plates from jobbers' stocks are not moving as rapidly as might be desired. We quote for warehouse shipment, 2.05c.

Sheets.—The firmness with which prices for black sheets are being maintained indicates that the weakness in galvanized sheets is due to the decline in spelter values rather than to a weakness in general conditions. There is, however, a degree of pressure in the

competition between some of the smaller mills and concessions are now noted in the neighborhood of $3 a ton, quotations being made on the basis of 3.35c., Pittsburgh. We continue to quote for Chicago delivery in carloads from mill: No. 28 black sheets, 2.53c.; No. 28 galvanized, 3.58c. to 3.68c.; No. 10 blue annealed, 1.93c.

We quote store prices without change as follows: No. 10 blue annealed, 2.25c.; No. 28 black, 2.90c.; No. 28 galvanized, 4.15c.

Bars.—Of the various kinds of steel bars those for reinforcing purposes have been in greatest demand recently. A number of the smaller implement contracts have been added to the mill bookings also. Specifications have been up to the average. Bar iron specifications and new business have been quiet, but the local mills still have too much business on their books to be very aggressive in pursuit of additional orders. We quote for mill shipment as follows: Bar iron, 1.57½c. to 1.62½c.; soft steel bars, 1.58c. to 1.65c.; hard steel bars, 1.60c. to 1.70c.; shafting in carloads, 58 per cent. off; less than carloads, 53 per cent. off.

For delivery from store, we quote soft steel bars, 1.95c.; bar iron, 1.95c.; reinforcing bars, 1.95c. base with 5c. extra for twisting in sizes ¾ in. and over, and usual card extras for smaller sizes; shafting 53 per cent. off.

Rivets and Bolts.—Pronounced weakness continues the prevailing characteristic in connection with bolt and rivet transactions. With the production exceeding consumers' needs by a substantial margin, there is no immediate prospect for better conditions. We quote from mill as follows: Carriage bolts up to ⅜ x 6 in., rolled thread, 75-10; cut thread, 75-5; larger sizes, 70-2½; machine bolts up to ⅜ x 4 in., rolled thread, 70-10-5; cut thread, 75-10; large size, 70-7½; coach screws, 80-10; hot pressed nuts, square head, $5.70 off per cwt.; hexagon, $6.30 off per cwt. Structural rivets, ¾ to 1¼ in., 2.38c., base, Chicago, in carload lots; boiler rivets, 0.10c. additional.

Out of store we quote for structural rivets, 2.70c., and for boiler rivets, 2.90c. Machine bolts up to ⅜ x 4 in., 70-7½; larger sizes, 65-5, carriage bolts up to ⅜ x 6 in., 70-5; larger sizes, 65 off. Hot pressed nuts, square head, $5.30, and hexagon, $5.90 off per cwt.

Wire Products.—Shipments of wire have fallen off rather sharply from the movement in April. The outlook for fence business is very encouraging. The leading interest is also pushing its fence post business, the demand increasing rapidly. We quote as follows to jobbers: Plain wire, No. 9 and coarser, base, $1.78; wire nails, $1.98; painted barb wire, $1.98; galvanized, $2.38; polished staples, $1.98; galvanized, $2.33, all Chicago.

Old Material.—Consumers are taking in little or no scrap and are almost making their own prices. Our quotations have been reduced from 25c. to 50c. on nearly all items and some grades are now as low as in 1911. Offerings of scrap by the railroads during the week included 2850 tons by the Chicago, Burlington & Quincy; 2300 tons by the Union Pacific at Omaha and Denver; 3800 tons by the Rock Island; 1250 tons by the Elgin, Joliet & Eastern, and 650 tons by the Grand Trunk, a total of 10,850 tons. The Standard Oil Company has for sale about 175 tons from its boiler shop at Whiting. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton.

Old iron rails	$15.75 to $16.25
Old steel rails, rerolling	13.25 to 13.75
Old steel rails, less than 3 ft.	11.75 to 12.25
Relaying rails, standard section, subject to inspection	24.00
Old carwheels	14.25 to 14.75
Heavy melting steel scrap	10.50 to 11.00
Frogs, switches and guards, cut apart	10.75 to 11.25
Shoveling steel	10.25 to 10.75
Steel axle turnings	9.00 to 9.50

Per Net Ton.

Iron angles and splice bars	$15.00 to $15.50
Iron arch bars and transoms	15.00 to 15.50
Steel angle bars	10.75 to 11.25
Iron car axles	19.75 to 21.25
Steel car axles	17.25 to 17.75
No. 1 railroad wrought	10.75 to 11.25
No. 2 railroad wrought	10.00 to 10.50
Cut forge	10.00 to 10.50
Steel knuckles and couplers	11.25 to 11.75
Steel springs	11.50 to 12.00
Locomotive tires, smooth	12.25 to 12.75
Machine shop turnings	5.50 to 6.00
Cast and mixed borings	5.25 to 5.75
No. 1 busheling	9.00 to 9.50
No. 2 busheling	6.75 to 7.25
No. 1 boilers, cut to sheets and rings	7.75 to 8.25
Boiler punchings	12.25 to 12.75
No. 1 cast scrap	11.25 to 11.75
Stove plate and light cast scrap	9.50 to 10.00
Railroad malleable	11.75 to 12.25
Agricultural malleable	10.50 to 11.00
Pipes and flues	8.00 to 8.50

Cast Iron Pipe.—The Cincinnati contract for 1900 tons was awarded to the United States Cast Iron Pipe & Foundry Company. At Bloomington, Ill., an award of 700 tons has been made to a contractor but the pipe has not been purchased as yet. The work at Big Rapids, Mich., is still pending, awaiting the complete financing of the improvements. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $28.50; 6 to 12 in., $26.50; 16 in. and up, $25.50, with $1 extra for gas pipe.

Philadelphia

PHILADELPHIA, PA., May 27, 1913.

Signs of increasing interest in the foundry iron market are apparent, but buyers still hesitate when it comes to placing orders for any considerable tonnage. Price uncertainties are still a factor, lower levels having developed for some brands. Prospective difficulties with molders have some bearing on the situation; threats of strikes are made but have not yet developed. Eastern heavy steel plate makers report increased orders, mostly miscellaneous business. Some few third-quarter contracts have been entered. In other finished material the market drags, and for the most part better deliveries are available. Ordinary iron bars are inclined to be weak. Foundry coke has been a trifle more active and more interest is shown in the furnace coke situation. The old material market is practically at a standstill.

Iron Ore.—Little business is moving either in foreign or domestic grades. The longshoremen's strike still interferes with the satisfactory unloading of ore, but has a less serious aspect. Importations during the week include 8855 tons of Newfoundland, 2800 tons of Venezuelan, 4800 tons of Canadian, 6175 tons of Swedish and 11,250 tons of Cuban ore.

Pig Iron.—Greater interest among consumers of foundry iron has developed and some little inquiry for third quarter is noted but most buyers hesitate to place anything but small orders for early shipment. Much of this hesitancy is due to the continued weakness of prices, although the uncertainty as to the action of foundry molders, who have asked for a wage advance, has some bearing on the situation. At many foundries threats of a strike have been made, but so far no action has been taken. Sales of foundry grades aggregated a larger total during the week, but made up almost entirely of small orders. A few producers still ask $17 delivered for standard brands of eastern Pennsylvania No. 24 foundry, but the bulk of the sales have been at $16.75 and several makers will, in close competition, accept $16.50. Virginia foundry iron has been selling a trifle more freely in moderate lots at $14, at furnace for No. 2 X and $13.75 for No. 2 plain. Some little business has developed in low grade foundry iron. Occasional odd lot sales of Northern off-grade irons have been made to cast-iron pipe makers and one 1000-ton lot of Southern No. 4 foundry was sold to a Delaware River melter at $11, Birmingham. Further business in Southern pipe making grades is pending. Rolling mill forge iron has been uncalled for and quotations are nominal. There has been little change in the steel making iron situation. It develops that a recent inquiry for 3500 tons of basic was merely for the purpose of obtaining quotations for comparison with other grades used by a central Pennsylvania melter. Basic consumers show practically no interest in the market. A sale of 900 tons of 0.035 phosphorus pig was made to a nearby steel casting plant at $23.25 delivered. Makers of standard 0.030 phosphorus pig maintain prices at $23.50, delivered here. The present range of pig iron prices is generally unprofitable to producers and some further talk of curtailment in production is heard. At the same time concessions are frequently made on strongly competitive business. The following range of prices about represents the market for standard brands, delivered in buyers' yards in this vicinity:

Eastern Pennsylvania No. 2 X foundry	$16.50 to $17.00
Eastern Pennsylvania No. 2 plain	16.25 to 16.50
Virginia No. 2 X foundry	16.80 to 17.00
Virginia No. 2 plain	16.55 to 16.75
Gray forge (nominal)	15.75
Basic (nominal)	16.50
Standard low phosphorus	23.50

Ferroalloys.—Transactions in 80 per cent. ferromanganese are confined to odd car loads for prompt shipment on which prices show a range from $59 to $61, seaboard, depending on the availability of the material for early shipment. For forward delivery the market is nominally $61 seaboard, but there is no demand. Ferrosilicon has been quiet.

Billets.—Consumers are showing more interest for requirements running into the third quarter, but very

little business has been closed. For early delivery Eastern mills are making few quotations, being well sold up for the remainder of the second quarter. Specifications on contracts come out freely. Mills are operating at full capacity and are being urged by customers for more rapid shipments. Prices continue well maintained, basic open-hearth rolling billets being still quoted at $28 to $30, delivered here, according to tonnage and time of delivery. Ordinary forging billets are quoted at $34 minimum, Eastern mill.

Plates.—Eastern mills report an increase in small orders, particularly for boiler and bridge plates. Some mills are entering small contracts at 1.75c. delivered for shipment over the third quarter and occasionally the second half. Comparatively good specifications on locomotive, boat and car plates are noted, but new business has not yet caught up with the rate of shipments. While better deliveries of Western plates are available at 1.60c. and 1.65c. here, Eastern mills hold pretty generally at 1.75c. for early deliveries.

Structural Material.—Deliveries on plain shapes are steadily improving. Shipments which in April were not available in less than 30 to 60 days can now be had in a few weeks. Eastern mills are still pretty well crowded on small shapes, it being hard to get anything better than eight weeks. On the larger sizes, however, deliveries are frequently available in two weeks. Considerable business in small lots comes out. Irwin & Leighton have the contract for the addition to the Arcade Building, 2000 tons, which will no doubt go to the Steel Corporation. The material for the Lackawanna bridges will, it is believed, go to the same interest. Fabricators are figuring on some 200 tons for an office building for the Pennsylvania Railroad at Pottsville, Pa. Prices of plain material are irregular, depending on the nature of the material desired as well as quantity. For small sizes 1.75c. Eastern mill is named, while 1.60c. to 1.65c. delivered here represents the general range of quotations for ordinary sizes.

Sheets.—A satisfactory run of miscellaneous orders is reported by mills in this district and makers find it difficult to keep up with the demand for hurried deliveries. Specifications come out freely and mill order books are comfortably filled for some time ahead. While there was some weakness in prices of Western sheets, makers have firmed up and No. 10 blue annealed Western sheets are firm at 1.90c. delivered here, while Eastern mills making smooth, loose-rolled sheets occasionally obtain 1.95c. here for particularly good shipments.

Bars.—Business in iron bars has ben confined largely to odd lots and occasional carload purchases. Very little tonnage business is offered, under which circumstance prices have not been seriously tested. For current small business ordinary iron bars are quoted at 1.57½c. to 1.62½c. delivered here. Some good orders for steel bars remain unplaced. Current sales are made at 1.55c. to 1.60c. here.

Old Material.—The market is practically at a standstill, although here and there an odd lot is sold at bargain figures. Consumers of heavy melting steel have refused to place orders at $12 delivered. Small sales of No. 1 steel have been made among dealers at $11.75, delivered, the material applying on old contracts. There has been no movement in special grades. Turnings and borings are particularly quiet. Moderate sales of stove plate have been made at $10, delivered. Quotations are practically nominal in all grades, but the following range about represents prices at which small transactions might be made for delivery in buyers' yards in this district, covering eastern Pennsylvania, taking freight rates varying from 35c. to $1.35 per gross ton:

No. 1 heavy melting steel	$11.50 to $12.00
Old steel rails, rerolling (nominal)	15.00 to 15.50
Low phosphorus heavy melting steel scrap	17.00 to 17.50
Old steel axles (nominal)	17.50 to 18.00
Old iron axles (nominal)	26.00 to 27.00
Old iron rails	18.00 to 18.50
Old carwheels	13.50 to 14.00
No. 1 railroad wrought	15.00 to 15.50
Wrought-iron pipe	12.00 to 12.50
No. 1 forge fire	11.00 to 11.50
No. 2 light iron (nominal)	6.75 to 7.25
No. 2 cut busheling	8.50 to 9.00
Wrought turnings	9.00 to 9.50
Cast borings	9.00 to 9.50
Machinery cast	13.50 to 14.00
Grate bars, railroad	10.00 to 10.50
Stove plate	10.00 to 10.50
Railroad malleable (nominal)	12.50 to 13.00

Coke.—Consumers of foundry coke are placing orders more freely, some contracts for moderate lots for third quarter having been closed. Prices show a wide range, according to grade, $2.75 to $3.25 at oven being paid. Moderate sales of furnace coke for near future delivery have been made at $2.25 at oven, although some makers are holding at higher figures. Prompt furnace coke ranges $2 to $2.15 at oven. The following range of prices, per net ton, is named for delivery in buyers' yards in this district:

Connellsville furnace coke	$4.05 to $4.50
Connellsville foundry coke	4.90 to 5.35
Mountain furnace coke	3.75 to 4.10
Mountain foundry coke	4.50 to 5.00

Cleveland

CLEVELAND, OHIO, May 27, 1913.

Iron Ore.—May shipments will not come up to expectations because of delays during the past week or more due to bad weather. Rains have interfered with unloading of upper lake docks and caused a shortage of cars. Early in the season there was a shortage of labor at the mines, but this seems to have disappeared and the supply of labor is expected to be adequate during the season. Owing to the inactivity of the pig iron market the additional buying looked for about the time of the opening of navigation has not materialized and some of the mines will probably not get out as much ore as they had planned. Predictions are now made that a 50,000,000-ton movement expected this season will not be reached. However, an active buying of pig iron and a demand for more ore later may put a different phase on the situation. We quote prices as follows: Old range Bessemer, $4.40; Mesaba Bessemer, $4.15; Mesaba non-Bessemer, $3.60; Mesaba non-Bessemer, $3.40.

Pig Iron.—Influenced by a weak market and declining prices buyers continue to play a waiting game and little business is expected until sellers show a determination to go no lower on prices. Very few consumers have bought foundry iron for the last half and with the end of the first half so near at hand an active market is expected when the buying gets started. However, some foundries have bought more iron than they will consume during the first half and will not need to buy for the first few weeks of the third quarter. Prices on foundry grades have further declined, but several sellers are not meeting present quotations and there are indications that the market will not go much lower. Cleveland and Valley prices on these grades are about 25c. a ton lower than last week, the general minimum quotation now being $14.25, Valley furnace, for No. 2 foundry. While the Cleveland market is nominally $15.25, delivered, a local furnace is asking for offers of $15, delivered, making this concession to shut out Valley iron that has a 90c. freight rate. Southern iron has settled down to $11.50, Birmingham, for No. 2. Buyers are waiting for an $11 price, but sellers are apparently not shading $11.50. For shipments during the year we quote, delivered Cleveland, as follows:

Bessemer	$17.50
Basic	$15.65 to 15.90
Northern No. 2 foundry	15.00 to 15.25
Southern No. 2 foundry	15.85
Gray forge	14.75
Jackson County silvery, 8 per cent. silicon	20.55

Coke.—There is a fair volume of inquiry for foundry coke for the last half, but few orders are being taken except for small lots. The general quotation on standard 72-hr. foundry coke is $3 per net ton at oven. However, some grades can be had at $2.75 and one or two producers are asking $3.25. We note the sale of 40 cars of Wise County foundry coke at $2.75 for delivery during 12 months. Furnace coke is quoted at $2.15 to $2.25 for spot shipment and $2.25 to $2.50 for contract.

Finished Iron and Steel.—The market shows some improvement both in sentiment and actual inquiries and orders. Some contracts are being placed for future delivery which in the case of one seller included steel bar tonnage for the first quarter delivery at 1.40c. For prompt shipment steel bars are being offered at 1.45c., Pittsburgh, and plates and shapes at 1.50c. to 1.55c. Weakness in the bar iron market in the Central West continues and a Chicago mill is now openly quoting bar iron at 1.50c. In Cleveland quotations are unchanged at 1.60c. to 1.65c. There is a heavy inquiry for bolt contracts from interests allied with the automobile industry. These inquiries aggregate 12,000,000 bolts and include one for 6,000,000 to 7,000,000 bolts. An Ohio sheet mill is asking for prices on 1000 to 2000 tons of sheet bars per month for two years. Forging billets are unchanged at $33, eastern mill; at $34.65, Pittsburgh. Sheets are generally quoted at 2.35c. for No. 28 black and 3.40c. to 3.50c. for No. 28 galvanized. Some of the smaller mills, however, appear to be shading black sheet prices $1 to $2 a ton. The demand for structural material is more active than for some time. The Otis

Steel Company has an inquiry out for 2500 tons for its new plate mill in Cleveland and another inquiry is from the Parish & Bingham Company, Cleveland, for 500 tons for a new factory. T. H. Brooks & Co., Cleveland, have taken 450 tons for a plant addition for the Firestone Tire & Rubber Company, Akron, in addition to 500 tons placed with the same fabricator a few weeks ago. Other contracts placed in Cleveland include 100 tons taken by the Forest City Steel & Iron Company for a factory building for the Rauch & Lang Carriage Co., 100 tons for a school building, 200 tons for a factory building for the Electric Controller & Mfg. Company and 150 tons for a city hospital building, taken by the National Iron & Wire Company, and 350 tons taken by a Cleveland shop for a car dumper. The Donovan Iron & Wire Company, Toledo, has taken 200 tons for new Lake Shore Railroad shops at Air Line Junction. An Ohio industrial concern has placed an order for 200 tons of standard section rails and another inquiry for 500 tons is pending. Warehouse prices are unchanged at 2.10c. for steel bars and 2.25c. for plates and structural material.

Old Material.—The market is very weak and prices on most grades in which there is any activity have further declined. Demand is light, being limited to very small lots. Only one Cleveland consumer is in the market for heavy steel scrap. This mill continues to offer $11.50 for this grade and is understood to be able to pick up some tonnage at that price. Turnings are very weak and Cleveland dealers have made sales in Pittsburgh as low as $7 per gross ton, delivered. We quote, f.o.b. Cleveland, as follows:

Per Gross Ton.	
Old steel rails, rerolling	$14.00 to $14.50
Old iron rails	16.00 to 16.50
Steel car axles	18.00 to 18.50
Heavy melting steel	11.50 to 11.75
Old carwheels	13.75 to 14.00
Relaying rails, 50 lb. and over	23.00 to 25.00
Agricultural malleable	11.75 to 12.00
Railroad malleable	13.00 to 13.25
Light bundled sheet scrap	9.50 to 10.00

Per Net Ton.	
Iron car axles	$21.00 to $21.50
Cast borings	6.50 to 6.75
Iron and steel turnings and drillings	4.75
Steel axle turnings	8.50 to 9.00
No. 1 busheling	10.00 to 10.25
No. 1 railroad wrought	12.00 to 12.50
No. 1 cast	11.75 to 12.00
Stove plate	8.00 to 8.50
Bundled tin scrap	11.00 to 11.50

Cincinnati

CINCINNATI, OHIO, May 27, 1913.

Pig Iron.—If there is any truth in the old saying that a calm precedes a storm, the long anticipated buying movement should soon commence in earnest, as the past week has been the most uneventful one here in months. Practically all sales made are of a minor nature, and simply for filling in. Consumers who have not covered for last-half requirements are yet awaiting developments, the majority of them expressing the opinion that bottom has not yet been reached. The foundry melt in this section shows a slight improvement, but not enough to deserve more than passing mention. Southern No. 2 foundry is quoted by a number of both Tennessee and Alabama furnaces at $11.50, Birmingham basis, for either prompt or last-half shipment, although several producers are holding out for $12. The high cost of coke and labor in the Hanging Rock district is keeping the price of southern Ohio No. 2 foundry firm at $15, Ironton, and if anything lower has been done it was probably a case of splitting commissions with the customer. The only foundry inquiry out calls for 500 tons of Southern iron, July-December shipment, for a southern Ohio melter. The two Indiana malleable inquiries, reported last week, are still hanging fire. A sale of about 2000 tons of malleable was recently made in St. Louis territory. Basic users show no signs of making any immediate contracts covering future requirements. Based on freight rates of $3.25 from Birmingham and $1.20 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 foundry and 1 soft.	$15.25 to $15.75
Southern coke, No. 2 foundry and 2 soft..	14.75 to 15.25
Southern coke, No. 3 foundry	14.55 to 14.95
Southern, No. 4 foundry	14.35 to 14.85
Southern gray forge	14.15 to 14.65
Ohio silvery, 8 per cent. silicon	20.20 to 20.70
Southern Ohio coke, No. 1	17.20 to 17.70
Southern Ohio coke, No. 2	16.20 to 16.70
Southern Ohio coke, No. 3	15.95 to 16.45
Southern Ohio Malleable Bessemer	16.20
Basic, Northern	16.20 to 16.45
Lake Superior charcoal	18.75 to 19.25
Standard Southern carwheel	27.25 to 27.75

Birmingham

BIRMINGHAM, ALA., May 26, 1913.

Pig Iron.—The order for the resumption of construction work at the new wire mill of the American Steel & Wire Company at Fairfield, Ala., is received with much satisfaction in the Birmingham district. The near approach of the close of the first half of the year and the prospective necessity of large pig iron purchases have added to the more cheerful feeling. Approach to the cost of manufacture has served to steady the downward tendency. Sales have been made of 200 and 800 tons of low grade iron on the basis of $11 for No. 4, the principal grade sold. Brokers disposing of carload and other small lots have obtained the $12 No. 2 basis with some regularity. Most of this busiess was done in Southern territory. The exact basis of some foreign sales is not known locally. Buying is still of a hand-to-mouth character. While $11.50 may be the basis of some transactions in strictly competitive territory, with some Tennessee furnaces offering iron at that price, the Alabama furnaces assert that the minimum for large orders is $11.75. The Republic Iron & Steel Company blew out one of its three furnaces for repairs, otherwise production is about on the level with prior months. Home consumption of Alabama pig iron is reported as at its maximum, and the autumn prospect in that respect is encouraging, as two large pipe plants and the wire mill are to be added to the home consumers. Quotations per gross ton at furnaces are continued at the following figures:

No. 1 foundry and soft	$12.25 to $12.75
No. 2 foundry and soft	11.75 to 12.25
No. 3 foundry	11.25 to 11.75
No. 4	10.75 to 11.25
Gray forge	10.25 to 10.75
Basic	11.75 to 12.25
Charcoal	24.50 to 25.00

Cast Iron Pipe.—Water pipe foundries are operating almost to capacity, although no large contracts have been placed in some time. The output is mainly of such sizes as come in readily for repairs and extensions. Prospects are considered better than they have been and it is believed that the volume of business will soon increase. We quote 4 in. at $22.50 and 6 in. and upward at $20.50 with $1 added for gas pipe. Soil pipe is comparatively active.

Coal and Coke.—Coke is scarce and strong. An order for 6000 tons for California and additional orders for Mexico have been secured by the Empire Coal Company and the Pratt Consolidated. We quote furnace coke, per net ton, at oven $3.25 to $3.50; foundry coke, $3.50 to $4 and $4.25 for best grades. Virginia coke is easier, and shipments into this territory are probable. Steam coal contracts have been accumulating with regularity. The Corona Coal & Coke Company has secured the yearly contract with the New Orleans & Northeastern for 500,000 tons. Mines continue to operate at full capacity, with no labor troubles.

Old Material.—There has been no improvement. Stocks are not increasing, and the outgo is only such as is in immediate demand. Nominal quotations, per gross ton, at dealers' yards, are as follows:

Old iron axles	$15.00 to $15.50
Old steel axles	15.00 to 15.50
Old iron rails	13.50 to 14.00
No. 1 railroad wrought	12.50 to 13.00
No. 2 railroad wrought	10.50 to 11.50
No. 1 country wrought	10.00 to 10.50
No. 2 country wrought	9.00 to 9.50
No. 1 machinery cast	10.00 to 10.50
No. 1 steel scrap	10.50 to 11.00
Tram carwheels	11.00 to 11.50
Standard carwheels	12.00 to 12.50
Light cast and stove plates	8.50 to 9.00

St. Louis

ST. LOUIS, MO., May 26, 1913.

The iron and steel market at this point continues rather quiet with some evidences of impending activity. Pig iron is weaker, but with no development of buying on lower prices.

Pig Iron.—The market showed a further decline to $11.50 for No. 2 Southern, Birmingham basis, but sales did not increase. A considerable number of representatives are still under instructions to hold the price at $12, the furnaces believing that nothing is to be gained by price cutting. Sales have ranged from car load lots up to 300 tons. One sale of 500 tons of No. 2 Southern is understood to have been a purchase to cover a short sale and is therefore not really new business. The purchases generally are thought to be for immediate

needs and melters are apparently determined to wait further developments before making the usual last-half contracts. A review of winter and spring buying shows that a considerable proportion of the consumers of this district are not covered for the last half, that their yards are not heavily stocked and that they have been melting iron practically as fast as received. Shipments on allotments keep right up to the original estimates of needs.

Coke.—There has been no business of moment beyond the usual requisitions on contracts. Connellsville, best 72-hr. selected is quoted at $2.75 to $3 per net ton at ovens for prompt to future shipment, the latter being firmly held. Furnace coke is $2.15 to $2.25 per ton at oven for prompt to future shipment. Virginia cokes and by-product cokes are held on the same basis.

Finished Iron and Steel.—The new business in the finished product market is reported to be about 75 to 80 per cent. of shipments and is practically all in small orders. Fabricating shops are not stocking up. A singular feature of the situation is that consumers pessimistic toward making contracts for future delivery are insistent for prompt delivery and even for anticipation of shipments under contract. In standard steel rails it is not expected that pending inquiries will eventuate into sales until after the close of the fiscal year. Bolts are in good demand, but spikes are rather slow. Light rails continue quiet. The new Waters-Pierce refinery in Oklahoma, about 1000 tons, will be closed shortly. Bars have been in very good demand as has reinforcing material. The wagon and agricultural interests have continued their activity and are taking all material obtainable.

Old Material.—The scrap market continues to grow weaker, with practically no demand and with the railroads still pushing large quantities out, despite the low prices. Dealers are hesitant about buying and stacking in the yards against future possibilities, although there was a tendency shown in this direction at last report. Relaying rails are still in demand with no supplies of consequence in sight; the price, therefore, is maintained. We quote dealers' prices, f.o.b. St. Louis, as follows:

Per Gross Ton.

Old iron rails	$12.00 to $12.25
Old steel rails, re-rolling	12.00 to 12.25
Old steel rails, less than 3 ft.	10.00 to 10.25
Relaying rails, standard section, subject to inspection	22.50 to 23.50
Old carwheels	12.75 to 13.00
Heavy melting steel scrap	10.25 to 10.50
Frogs, switches and guards cut apart	9.75 to 10.00

Per Net Ton.

Iron fish plates	$10.75 to $11.00
Iron car axles	18.25 to 18.50
Steel car axles	15.75 to 16.00
Wrought arch bars and transoms	13.25 to 13.50
No. 1 railroad wrought	10.00 to 10.25
No. 2 railroad wrought	9.50 to 10.00
Railway springs	8.25 to 8.50
Steel couplers and knuckles	8.25 to 8.50
Locomotive tires, smooth	10.25 to 10.50
No. 1 dealers' forge	6.75 to 7.00
Mixed borings	5.00 to 5.25
No. 1 busheling	8.25 to 8.50
No. 1 boilers, cut to sheets and rings	5.25 to 5.75
No. 1 cast scrap	8.25 to 8.50
Stove plate and light cast scrap	7.25 to 7.50
Railroad malleable	8.75 to 9.00
Agricultural malleable	7.25 to 7.50
Pipes and flues	5.75 to 6.00
Railroad sheet and tank scrap	5.00 to 5.25
Railroad grate bars	6.25 to 6.50
Machine shop turnings	6.00 to 6.25
Bundled sheet scrap	5.00 to 5.25

Price Declines in British Market

General Trade Practically Suspended—Steel Weak—Chili Inquiring for Rails

(By Cable)

LONDON, ENGLAND, May 28, 1913.

Up to 70s. 6d. cash has been paid for Cleveland pig-iron warrants and sellers are asking 71s. 6d. Legitimate business is practically suspended and stocks of iron are growing persistently, the stocks in Connal's stores being 240,301 tons, against 230,817 last week. Galvanized sheets are weak and mills are closing, but fifty tin plate mills have resumed and more are going in. French works are keen sellers of semi-finished steel and 2-in. billets have sold for 88s., f.o.b. Consumers are holding off, freightened at the declines. Chili is inquiring for 10,000 tons of rails. We quote as follows:

Cleveland pig-iron warrants (Tuesday), 71s. 6d. asked, against 69s. 6d. a week ago.

No. 3 Cleveland pig iron, makers' price, f.o.b. Middlesbrough, 70s., the same as last week.

Ferromanganese, £11 12s. 3d., f.o.b. shipping port.

Steel sheet bars (Welsh) delivered at works in Swansea Valley, £5 5s.

German sheet bars, f.o.b. Antwerp, nominally 95s., a decline of 8s.

German 2-in. billets, f.o.b. Antwerp, nominally 92s., a decline of 8s.

German basic steel bars, f.o.b. Antwerp, £5 8s., a decline of 1s.

Steel bars, export, f.o.b. Clyde, £7 17s. 6d.

Steel joists, 15-in., export, f.o.b. Hull or Grimsby, £6 17s. 6d., a second decline of 2s. 6d.

German joists, f.o.b. Antwerp, £5 12s. to £5 15s.

Steel ship plates, Scotch, delivered local yards, £8 7s. 6d.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £9 10s., a decline of 5s.

Steel rails, export, f.o.b. works port, £6 15s.

Tin plates, cokes, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 14s., a decline of 3d.

Greater German Pressure for Orders

Work in Hand Is Running Low—Dullness Rules in All Branches

BERLIN, May 16.

In some lines the old orders taken before the present stagnation set in are now running pretty low, and consequently the pressure to obtain new business is growing sharper. A bad feature is that the machinery and electrical industries are by no means placing as good new orders for material as in previous years. The general feeling is rather pessimistic, aggravated by the further tension in money rates, which are now higher than they have ever been at this season.

Further Cuts in Prices

Prices are still tending lower. Two days ago the kartell of West German Iron Dealers voted that the various sub-organizations which have not yet reduced their prices should now make cuts of 5 to 10 marks in bars, plates, and bands. Manufacturers, too, are reducing bar prices; the de Wendel mill has just made a cut of 3 marks. The belief prevails in the market that speculative sales of bars at artificially reduced prices have lately occurred on a considerable scale.

The Belgian market maintains its steady downward course. At the end of last week a further drop of a shilling in the export price of iron bars and heavy and light plates of basic steel were made. Export prices of semi-finished steel have been reduced 2 shillings.

One can yet hear expressions of hopefulness, however, in some sections of the trade. In the Silesian district it is reported that a big home demand has only been held in check by the political uncertainty of past months; this is expected to lead to much new business as soon as peace has actually been declared. It is also expected there that the Balkan countries will absorb large amounts of iron and steel as soon as they return to the arts of peace. Specifications are arriving at a good pace in that district, and delivery periods of four to five weeks are still stipulated by manufacturers.

Heavy Steel Syndicate Shipments

The shipments of the Steel Works Union for April amounted to 566,289 tons, which means the heaviest movement since June, 1912. Shipments for four months reached 2,170,000 tons, or 48,000 tons more than in the corresponding period of 1912. Steel rail shipments in April exceeded any other month since March, 1912. They reached 234,252 tons, which compares with only 151,688 tons for March. Rail shipments for four months amounted to 926,000 tons, or 138,000 tons more than last year. The movement in structural shapes in April showed a good gain over previous months. It was 193,327 tons, or the largest since last August. Shipments of semi-finished steel were less than for any month since April, 1912. The Union will adopt about the end of the month the price scale for the next quarter. No change in prices is looked for.

It is reported that the Wire Rod Association, after all efforts to get a renewal for five years had failed, has a very good prospect to be prolonged for one year. A decision of the matter is expected next week.

The Hardware Trade Not Active

From the hardware trade reports are not encouraging. The situation has further weakened. Little new business is coming in, except in a few special lines, and even specifications on existing orders are not arriving as they should. The export demand is light. In the Solingen cutlery trade the shops are still pretty well employed, but the export situation has weakened for ordinary cutlery. Builders' hardware is dull, owing to the unfavorable condition of the building trade. The same cause is affecting the wire nail trade badly. There is a good export movement, but at unsatisfactory prices. Manufacturers of screws and rivets still have a fair amount of work in hand, but new orders are coming in slowly.

Boston

BOSTON, MASS., May 27, 1913.

Old Material.—The market is lifeless. Quoted prices have fallen sharply, but the changes are largely nominal, because there is nothing to give a real line on values. The quotations given below are based on prices offered by the large dealers to the producers and to the small dealers and collectors, per gross ton, carload lots, f.o.b. Boston and other New England points which take Boston rates from eastern Pennsylvania points. In comparison with Philadelphia prices the differential for freight of $2.30 a ton is included. Mill prices are approximately 50c. a ton more than dealers' prices:

Heavy melting steel	$9.00 to $9.50
Low phosphorus steel	13.50 to 14.50
Old steel axles	13.50 to 14.00
Old iron axles	21.00 to 21.50
Mixed shafting	13.00 to 13.25
No. 1 wrought and soft steel	10.25 to 10.50
Skeleton (bundled)	7.50 to 8.00
Wrought-iron pipe	8.50 to 9.00
Cotton ties (bundled)	8.50 to 9.00
No. 2 light	3.50 to 4.00
Wrought turnings	5.50 to 6.00
Cast borings	5.50 to 6.00
Machinery, cast	11.50 to 12.00
Malleable	10.00 to 10.50
Stove plate	7.75 to 8.25
Grate bars	6.75 to 7.00
Cast-iron carwheels	13.50 to 14.00

Buffalo

BUFFALO, N. Y., May 27, 1913.

Pig Iron.—Buying in all grades continues to be slack, although a few orders for malleable are reported. One cause acting to restrain consumption is the scarcity of labor and the condition of labor unrest that is becoming acute in some sections of the district. If these conditions do not improve and placement continues to be held in abeyance, there will undoubtedly be a sharp reduction in production of pig iron as prices are now said to be at such a low level as not to be remunerative. Two or three furnaces tributary to this district have already gone out and it is quite likely one or two more will go out within the next few weeks unless an improvement in buying should set in. The volume of business has been so small that it is difficult to establish a well-defined schedule of prices. The general level is somewhat lower than reported last week and approximates $15 as a general average of the foundry grades. In some grades there has not been sufficient sales to determine definitely the market price. The prices shown below approximate the market as closely as possible for current quarter and last-half delivery, f.o.b. Buffalo:

No. 1 foundry	$15.00 to $15.75
No. 2 X foundry	14.75 to 15.00
No. 2 plain	14.75
No. 3 foundry	14.50
Gray forge	14.50
Malleable	15.25 to 15.75
Basic	16.00 to 16.50
Charcoal	16.50 to 17.50

Finished Iron and Steel.—The demand for rush delivery in bars, shapes and plates is still insistent, indicating that all the material is going into actual consumption. Strictly new business is very quiet and limited to sizes and material not covered by contracts. Full specifications are being placed against contracts to meet monthly quotas. No large increase in demand is anticipated for the next two or three months, as present contracts will largely care for that period. With the continuance of the present bright crop prospects, a renewed buying movement is looked for early in the fall for delivery the first half of next year. The week has shown good business in black and galvanized sheets, but at slightly softer prices. Bar prices are firmly held, with absolutely no change. Standard and line pipe has taken an advance of ½ point, effective to-day. Active demand is noted in fabricated structural material particularly for small lot business and building projects of moderate size. The Buffalo Structural Steel Company has the City Hall building at Tonawanda, N. Y. The Jones & Laughlin Steel Company will supply 100 tons for public school No. 24 at Rochester and the George Kellogg Structural Company, Buffalo, 100 tons for an addition for the American Brewing Company, Rochester.

Old Material.—The market shows some increase in activity, but at lower prices for some commodities. The principal local consumer of scrap has resumed taking material covered by existing contracts. On new business heavy melting steel is now quoted at $11.50 to $12, a reduction of 50c. per ton as compared with last week. There has also been a further drop in prices for a number of other lines of scrap materials, including railroad malleable, old carwheels, wrought pipe, turnings and borings and busheling scrap, and the general opinion is apparently that the bottom has not yet been reached. We quote as follows, per gross ton, f.o.b. Buffalo:

Heavy melting steel	$11.50 to $12.00
Boiler plate, sheared	13.50 to 14.50
No. 1 busheling scrap	10.50 to 11.00
No. 2 busheling scrap	8.00 to 8.50
Low phosphorus steel	17.00 to 17.50
Old iron rails	15.00 to 15.50
No. 1 railroad wrought	14.00 to 14.50
No. 1 railroad and machinery cast scrap	13.75 to 14.25
Old steel axles	17.50 to 18.00
Old iron axles	24.00 to 24.50
Old carwheels	14.50 to 15.00
Railroad malleable	12.50 to 12.75
Locomotive grate bars	10.00 to 10.50
Stove plate (net ton)	9.75 to 10.00
Wrought pipe	9.50 to 10.00
Wrought iron and soft steel turnings	6.00 to 6.50
Clean cast borings	7.50 to 8.00
Bundled tin scrap	16.00

New York

NEW YORK, May 28, 1913.

Pig Iron.—Inquiry is increasing and it has been a better week for sales. A Connecticut transaction involving 3000 tons of foundry iron of 1.50 per cent. silicon and upward has been a good deal talked about, as the delivered price, reported at close to $16.50, would mean a new low point for this year at the Buffalo and central Pennsylvania furnaces credited with taking the business. It would mean $14.50 for No. 2 X at Buffalo, which is probably close to the present market. The large buyers having plants at various points, but making all their purchases in New York, are very closely watching the present situation and in a few cases they have shown interest enough to seek quotations. In one case the inquiry is for 6000 tons. An eastern Pennsylvania machinery foundry has asked for a round lot. Some few sales have been made for second-quarter delivery, including one of 1300 tons. In the Buffalo district considerable iron is being figured on in a tentative way. Buyers recognize that with the coming off of 50c. in the past week or ten days prices have come close to the point at which there will be a movement of iron or some furnaces will get out of the race. It is recalled that at this time last year a good deal of $13.50 and $14 Buffalo iron was moving, but on the other hand is the fact of higher ore and higher coke. Foundry iron consumption in this district is holding up for the most part and in foundry products the demand is still generally well maintained. We quote Northern iron for tidewater delivery as follows: No. 1 foundry, $16.75 to $17; No. 2 X, $16.25 to $16.50; No. 2 plain, $16 to $16.25. Southern iron is quoted at $16.50 to $16.75 for No. 1 foundry and $16.25 to $16.50 for No. 2.

Structural Material.—With new demand of relatively small proportions and shipments from mills heavy it is not surprising to hear of better deliveries. New inquiry has dropped off considerably, particularly with the railroads, but bids will shortly be taken on some more of the elevated railroad extension of the subway work in Queens, involving probably over 10,000 tons, and also on what is known as section 4 of route 4 of the subway systems. Some steel work will undoubtedly be required for a colony of buildings to be built on Long Island for a State school of agriculture, as approved recently by the New York State Legislature. The recent structural awards include about 2200 tons for 12 bridges for the Delaware, Lackawanna & Western, given to the American Bridge Company; 680 tons for an office building in Hartford, given to the Levering & Garrigues Company; 400 tons for an apartment on West Eighty-ninth street, to the Hay Foun-

dry & Iron Works, and quite a number of smaller building contracts, all of which could not be authenticated. The Baltimore & Ohio is taking bids on over 2500 tons of bridge material. Mill shipments are obtainable in five to six weeks at 1.45c., Pittsburgh, with 1.50c. for earlier delivery and 2.15c. from store.

Plates.—There is a little more active canvassing for business for delivery in several weeks at 1.45c. and 1.50c., Pittsburgh, but eastern Pennsylvania mills are still holding for 1.60c., Pittsburgh, having, it is believed, refused some weeks ago to enter into contracts for the latter half, or at least the third quarter, at 1.50c., Pittsburgh. Some railroad car buying has been done, but some of this under peculiar circumstances indicating that the difficulty is still chiefly one of financing purchases. The largest awards are 5000 cars for the Erie, 3000 for the Chesapeake & Ohio system and 2000 for the Lehigh Valley. The Erie business was distributed among the following: Standard Steel Car Company, 500 hopper, 500 gondola and 1500 box; American Car & Foundry Company, 1500 box, and the Pressed Steel Car Company, 1000 hopper cars. Of the Chesapeake & Ohio business 2000 70-ton hopper cars were awarded to the Standard Steel Car Company and 1000 50-ton hopper, for the Hocking Valley, to the Ralston Steel Car Company. It is understood also that the Standard Steel Car Company has closed with the Lehigh Valley for 1000 box and 1000 coal cars, and the Baltimore & Ohio has bought 7 postal cars from the American Car & Foundry Company. The International Great Northern is in the market for 200 coal and 300 box cars. We continue to quote 1.61c. to 1.66c., New York, for mill shipments in the last half and 1.76c., New York, for delivery in two to four weeks.

Bars.—Deliveries are better but new inquiry is still dull. No unusual conditions were learned of. Bar iron still shows quite a wide spread in market quotations, figures being, as stated recently in this column, all the way from 1.50c. to 1.70c. at mill. We quote bar iron at 1.60c. to 1.65c., New York, and steel bars, 1.56c., New York, deliveries depending on the mill. Store prices are 2.05c. for steel bars and 2.10c. for iron bars.

Cast Iron Pipe.—The city of Schnectady, N. Y., opens bids today on 1500 tons of 24-in. John J. F. Mulcahy, contractor for the greater part of the extension to the New York City high pressure fire protection system, has purchased the 10,300 tons of pipe required for his contract from the Warren Foundry & Machine Company, and that company will now furnish the pipe for the whole of this work, comprising about 11,000 tons. R. D. Wood & Co. were awarded the Newark, N. J., contract May 22 for about 600 tons of 36 in. at $20.74 per ton, delivered. That firm was considerably lower than other bidders. The past week has been marked by a decided increase in private buying. Much more business has been closed than of late, while the inquiry continues active. Prices of carload lots of 6 in. are $23 to $24 per net ton, at tidewater, New York, with some makers holding for a still higher price.

Old Material.—The only transaction reported in heavy melting steel scrap was a sale of 1000 tons at $12 delivered in eastern Pennsylvania. A few sales of cast scrap have been made to nearby foundries, the largest being 200 tons. The general market has been exceedingly dull, and in quite a number of commodities no transactions whatever have transpired. About the best price now obtainable for heavy melting steel scrap is $11.75, eastern Pennsylvania. This price is within 25c. of being as low as was experienced in the depression of 1910-1911 and represents a drop of over $4 in five months. Values of old material are now getting down to where holders will refuse to part with their stock. Quotations are about as follows, per gross ton, New York, the inside figures representing prices offered by dealers:

Old girder and T rails for melting	$9.25 to	$9.75
Heavy melting steel scrap	9.25 to	9.75
Relaying rails	22.00 to	22.50
Rerolling rails	12.50 to	13.00
Iron car axles	22.50 to	23.00
Old steel car axles	14.50 to	15.00
No. 1 railroad wrought	12.25 to	12.75
Wrought iron track scrap	11.50 to	12.00
No. 1 yard wrought, long	11.25 to	11.75
No. 1 yard wrought, short	10.25 to	10.75
Light iron	4.00 to	4.50
Cast borings	6.00 to	6.50
Wrought turnings	6.00 to	6.50
Wrought pipe	9.50 to	10.00
Old carwheels	12.00 to	12.50
No. 1 heavy cast, broken up	11.00 to	11.50
Stove plate	8.75 to	9.25
Locomotive grate bars	7.50 to	8.00
Malleable cast	10.00 to	10.50

Ferroalloys.—The agents of the large English producers of 80 per cent. ferromanganese continue to quote $61, Baltimore. Small lots in merchants' hands have sold down to $59, and there are still offerings at or near that figure but they are fewer than heretofore for the reason that a good part of the resale material has been absorbed. New demand is quiet. Quotations of 50 per cent. ferrosilicon are unchanged at $75, Pittsburgh, for carloads, $74 for 100 tons and $73 for 600 tons and over.

Metal Market

NEW YORK, May 28, 1913.

The Week's Prices

Cents Per Pound for Early Delivery.

	Copper, New York.			Lead		Spelter	
May	Lake.	Electrolytic.	Tin, New York.	New York.	St. Louis.	New York.	St. Louis.
22	15.75	15.65	48.65	4.35	4.20	5.45	5.30
23	15.75	15.65	48.37½	4.35	4.20	5.40	5.25
24	15.75	15.65	.....	4.35	4.20	5.40	5.25
26	15.75	15.65	48.45	4.35	4.20	5.40	5.25
27	15.75	15.65	48.80	4.35	4.20	5.40	5.25
28	15.75	15.65	48.75	4.35	4.20	5.40	5.25

Copper is quiet, with resale lots offered at concessions. Tin buying is small and irregular, with prices fairly well maintained. Lead is a little stronger. Spelter is dull and lower. Antimony continues quiet, with quotations below the import price.

New York

Copper.—The market has been quiet and no resumption of heavy buying is looked for until about June 10 when the May statistics of the Copper Producers' Association will be known. It is expected that the figures will show good deliveries, both domestic and foreign. The exports of copper this month are 33,964 tons. The large agencies are holding to their prices of 16c., cash, for Lake and 15.75c., cash, 30 days, for electrolytic, but these quotations are nominal in the absence of any buying of real importance. Sales of small outside lots of electrolytic have been made at 15.65c., cash, New York, but it is safe to say that this price would not last long were some good buying to occur. Lake copper is nominally quoted at 15.75c., but is hard to find. On the other hand, some authorities construe the market as not overstrong because of the falling off in the demand for products into which copper enters. At the present time manufacturers of such products are well employed in satisfying insistent customers who are very busy. The situation indicates that stocks on merchants' shelves are small. The morning quotation for spot copper in London to-day was £68 7s. 6d. and of futures £68 2s. 6d.

Pig Tin.—The market has been quiet. There has been some spasmodic buying, though at no time were any large lots taken. On some days not a pound was sold and on others business was such as ordinarily would create only casual interest. Consumption is fairly good and the explanation of the inactivity is that users filled their requirements amply a few weeks ago. The market abroad has shown a strengthening tendency in the last few days in anticipation of high prices at the auction sale of 2500 tons of Banca tin which took place in Amsterdam, Holland, to-day. The sale realized 135⅝ florins, about equivalent to 49.45c., c.i.f. New York, but the high price seemed to have overshot the mark and on receipt of the information the London market declined £1 instead of advancing. The price of tin is quoted in New York this morning at 48.75c. In London the quotation was £221 5s. for spot and £217 10s. for futures. The arrivals this month total 2947 tons and there is afloat 1490 tons.

Lead.—This metal is a trifle stronger in the West than in the East. It is quoted at 4.35c., New York, and 4.20c., St. Louis, though from the latter city there have come reports of a few sales at 4.22½c. Stocks are reported as rather light everywhere, and due to this and because shipments are running below the same period of a year ago lead is considered to be in a fair position.

Spelter.—In a very dull market spelter is lower at 5.40c., New York, and 5.25c., St. Louis, and there is some talk of sales having been made a few points lower. In some quarters it is stated that the price is only getting back to its natural level and that the prices of spelter and lead have been too far apart. In London in the last week prices dropped from £25 to £23 per ton. Cabled advices gave no reason for the decline other than a dull demand.

Antimony.—Quotations continue irregular, but all are below the import cost of the metal. There is very little buying. Quotations are around 8.70c. for Cookson's, 8.20c. for Hallett's and 7.50c. for Chinese and Hungarian grades.

Old **Metals.**—The market is dull. While dealers' selling prices are unchanged they are only nominal as follows:

	Cents per lb.
Copper, heavy and crucible	15.00 to 15.25
Copper, heavy and wire	14.75 to 15.00
Copper, light and bottoms	13.00 to 13.25
Brass, heavy	9.50 to 9.75
Brass, light	8.25 to 8.50
Heavy machine composition	13.75 to 14.00
Clean brass turnings	8.75 to 9.00
Composition turnings	11.50 to 12.50
Lead, heavy	4.25
Lead, tea	4.00
Zinc, scrap	4.25

Chicago

MAY 26.—The only changes of interest are associated with the further decline in the price of spelter and the fluctuations in tin. Zinc quotations are also lower. Copper sales for nearby shipment and spot delivery were active and prices remain firm. Old metal prices show slightly higher levels. We quote as follows: Casting copper 15.75c.; Lake, 16c. to 16.25c. in carloads for prompt shipment; small lots, ¼c. to ⅜c. higher; pig tin, carloads, 49.50c., small lots, 51.50c.; lead, desilverized, 4.35c. to 4.40c.; corroding, 4.60c. to 4.65c., for 50-ton lots; in carloads, 2½c. per 100 lb. higher; spelter, 5.35c. to 5.40c.; Cookson's antimony, 10.50c., and other grades, 9.75c., in small lots; sheet zinc is $7.50 f.o.b. La Salle or Peru, Ill., less 8 per cent. discount in carloads of 600-lb. casks. On old metals we quote buying prices for less than carload lots: Copper wire, crucible shapes, 14c., copper bottoms, 13c.; copper clips, 13.75c.; red brass, 13c.; yellow brass, 9.75c.; lead pipe, 3.90c.; zinc, 4.35c.; pewter, No. 1, 33c.; tinfoil, 40c.; block tin pipe, 44c.

St. Louis

MAY 26.—Lead and spelter have been dull at 4.20c. and 5.25c., respectively. Tin was quiet, the closing quotations being 48.85c. to 49.10c. Lake copper closed at 16.35c. and electrolytic copper at 16.22½c. Cookson's antimony was 9.10c. to 9.35c. In the Joplin ore market there was little change from the situation of the preceding week so far as prices were concerned. On miscellaneous scrap metals we quote as follows: Light brass, 6c.; heavy brass and light copper, 9.50c.; heavy copper and copper wire, 11c.; pewter, 25c.; tinfoil, 34c.; zinc, 3.50c.; lead, 3.50c.; tea lead, 3c.

The Coaster Brake Combination

Certain coaster brake manufacturers having pleaded guilty or entered pleas of nolle contendere to a violation of the Sherman anti-trust law, fines were imposed on them in the United States District Court at Rochester, N. Y., May 27. The corporations and their fines were as follows: New Departure Mfg. Company, $1000; Corbin Screw Corporation, $10,000; Eclipse Machine Company, $10,000; Miami Cycle & Mfg. Company, $10,000; Buffalo Metal Goods Company, $2000; Aurora Automatic Machinery Company, $2000. Fines were also imposed on a number of individuals, including Edwin E. Jackson, Jr., arbitrator for the combination, $3500; Frederick R. Huntington, arbitrator, $5000; Gales P. Moore, patent attorney, $1000. Several cases were discontinued. The decree made by the court does not prohibit the New Departure Mfg. Company from licensing other firms to use its patents.

New York Machinery Club Election

The New York Machinery Club held its annual meeting on Tuesday, May 27. The following were re-elected members of the board of governors to serve four years: Robert C. McKinney, president Niles-Bement-Pond Company; Leon P. Feustman, vice-president International Steam Pump Company; Charles A. Schieren, Jr., president Charles A. Schieren Company; E. D. Meier, president Heine Safety Boiler Company, and Edwin A. Stillman, president Watson-Stillman Company. The board will elect officers at a meeting to be held at an early date. George A. Post, president Standard Coupler Company, president of the club, in addressing the members, dwelt in particular on the satisfactory showing of Treasurer Schieren. The club is not only out of debt, but on a sound financial footing. At the close of the fiscal year March 31 the roster included 636 resident, 386 non-resident, 103 suburban and 12 army and navy members. As the resident members are limited to 800, it is considered probable that the club will have a waiting list in the near future.

Iron and Industrial Stocks

NEW YORK, May 28, 1913.

Transactions in securities have been light, but Stock Exchange prices showed a tendency to somewhat higher values until Tuesday of this week when a sharp recession occurred. The range of prices on active iron and industrial stocks from Wednesday of last week to Tuesday of this week has been as follows:

Am. Can, com.	32⅛- 34½	Pressed Steel, com.	24 - 24¾
Am. Can, pref.	92½- 94⅜	Pressed Steel, pref.	95½
Am. Car & Fdy., com.	47⅞- 49	Railway Spring, pref.	93⅝- 94⅜
Am. Car & Fdy., pref.	112⅞-113⅜	Republic, com.	23 - 23⅜
Am. Loco., com.	32 - 33⅜	Republic, pref.	81¾- 82½
Am. Loco., pref.	102	Rumely Co., com.	25¼- 29
Am. Steel Foundries	31	Rumely Co., pref.	50 - 54
Bald. Loco., com.	49 - 50	Sloss, com.	31 - 33
Bald. Loco., pref.	105¼	U. S. Steel, com.	59½- 61⅛
Beth. Steel, com.	32½- 33	U. S. Steel, pref.	105½-106½
Beth. Steel, pref.	69½- 71	Va. I. C. & Coke	40 - 41
Case (J. I.), pref.	99¾-100	Westinghouse Elec.	62 - 62½
Colorado Fuel	30¼- 31⅜	Am. Ship, com.	52
Deere & Co., pref.	97½- 97⅝	Chic. Pneu. Tool	49¾- 50
Emer-Brant, com.	30 - 32	Cambria Steel	47 - 49¾
General Electric	138⅞-140⅛	Lake Sup. Corp.	26 - 26½
Gr. N. Ore Cert.	33¼- 34⅜	Pa. Steel, pref.	63 - 64
Int. Harv., com.	104 -106	Warwick	10⅛- 10⅝
Int. Harv., new	103⅜	Crucible Steel, com.	13¾- 14
Int. Harv., pref., new	112½	Crucible Steel, pref.	88 - 88¼
Int. Harv. Corp.	103¾-104	Harb. Walk Ref., com.	44½
Int. Harv. Corp., pref.	113⅛-114⅛	Harb. Walk Ref., pref.	102½
Int. Pump, com.	7¼- 8	La Belle Iron, com.	42¾- 45
Nat. En. & St., pref.	78		

The Independent Pneumatic Tool Company's directors plan 1 per cent. quarterly dividends on $3,000,000 capital stock. The dividend rate on $500,000 stock, recently increased sixfold, was 10 per cent. The company has around $1,250,000 surplus.

On July 1 the Farmers Deposit National Bank, Pittsburgh, will pay off and redeem at accrued interest and a premium, as provided in the mortgage, approximately $315,000 of the outstanding first mortgage and collateral trust 5 per cent. gold bonds of the Harbinson-Walker Refractories Company, dated July 1, 1902. The last report of the company showed $1,050,000 of these bonds outstanding. The bonds to be redeemed are numbered irregularly from 54 to 2000, inclusive. Interest on the bonds designated will cease after July 1.

Dividends Declared

The General Electric Company, regular quarterly, 2 per cent., payable July 15.

The New York Air Brake Company, regular quarterly, 1½ per cent., payable June 20.

The Baldwin Locomotive Works, regular semi-annual, 1 per cent. on the common and 3½ per cent. on the preferred stock, both payable July 1.

The Railway Steel Spring Company, regular quarterly, 1¾ per cent. on the preferred stock, payable June 20.

Empire Ore Miners' Strike Settled

The Empire Steel & Iron Company after a conference lasting two days, effected a settlement with its striking ore miners at Mt. Hope, N. J., May 27. The company agreed to an 8-hour working day to underground men and a 9-hour day to surface men; also to re-employ its old men without discriminating against members of the Western Federation of Miners. The company refused to discharge those who remained faithful during the strike and does not recognize the union. The beginning of the trouble was on March 24, so that the strike lasted over two months.

A new safety device, the Welch hoisting engine controller, has been adopted at all the collieries of the Lehigh Valley Coal Company, after a thorough trial of over a year. It prevents the elevator, or "cage," from overrunning its distance and hitting the wheel at the top of the shaft when the men are being hoisted out of the mine by automatically shutting off the steam from the engine and applying the brake unless the cage has slowed down to about 70 ft. from the top of the shaft. Every moment that the car is rising a finger is traveling steadily toward the safety release trigger which operates the controller but which retreats slowly as the speed of the car decreases. Less than a quarter of an extra turn of the drum on which the hoisting cable is wound causes the finger to hit the trigger and brings the car to a standstill.

Customs Decisions

Rotary Printing Presses

The Board of United States General Appraisers has sustained a protest filed by the National Cash Register Company, affecting the classification of rotary printing presses used for printing pictures on paper from engraved copper rolls. The machines, it was shown at the hearing, are not suitable for lithographic printing nor for printing from type. They are known as Mertens rotary intaglio printing presses. It was testified that they do not emboss, but apply the ink, the result being a print, or a printed picture known as intaglio printing. Duty was assessed at 45 per cent. ad valorem under paragraph 199, as "manufactures of metal," while the importers claimed a rate of 30 per cent. under paragraph 197, which provides for "printing presses." In sustaining the protest, Judge Fischer said in part:

> We are of the opinion that the provision for printing presses is not limited to such as print from type or from flat metal plates. It is broad enough to include the articles here in question. The claim in the protest at 30 per cent. is sustained.

Tin Disks

The Teller Iron Company failed to receive relief from duty exacted by the Chicago customs officers on importations of circles or disks of tin measuring 2⅛ in. in diameter. The goods are cut or stamped out of sheets of tin plate and were assessed at 45 per cent. ad valorem under paragraph 199, as "manufactures of metal" not specially provided for. They were claimed dutiable at 10 per cent. under the provision in the law for "waste, not specially provided for." The board held that it was unable to make any distinction in principle between the tin disks here in question and those that were passed upon by the tribunal in the case of Shallus vs. the United States. On the authority of that ruling the assessment in the present case was affirmed.

Harvesting Machines

In sustaining a contention raised by Alexander Morrison, the board held that it was the intent of Congress to give a broad interpretation to the provision in the present tariff act for harvesters. The merchandise in controversy consisted of so-called Stewart sheaf loaders. Duty was assessed by the customs officials at Pembina at 45 per cent. ad valorem under the provision for "manufactures of metal" not specially provided for. The importer asked for a duty of 15 per cent. under paragraph 476 on the ground that the machines in question are harvesters. The importer proved to the satisfaction of the board that the loaders are used only in harvesting operations.

Cold-Rolled Sheets

Adverse action was taken in the case of the George Nash Company, objecting to the assessment made by the collector at New York on sheets of iron, cold rolled. Duty was taken at 30 per cent. ad valorem as "sheets" valued at over 3c. per lb. under the provisions of paragraph 127 with the additional 2/10 of 1c. per lb. for cold rolling under the proviso of paragraph 129. The merchandise was claimed dutiable under paragraph 120, at the rates therein provided for "bars or shapes of rolled or hammered iron." In overruling the protest, the decision said:

> The provision in paragraph 127, reading "sheets of iron or steel, common or black, of whatever dimensions," seems to us to apply to the present importation consisting of iron of the dimensions given, i. e., 6 in. wide, 6 ft. long and either 1/32 or 3/32 in. thick. There is nothing in the record as it is presented to us for our consideration to warrant a contrary conclusion.

Move for a Government Armor Plate Plant

The bill introduced by Senator Ashhurst, of Arizona, providing an appropriation of $1,600,000 for the erection of a Government armor plate plant, has been referred to the Senate Committee on Naval Affairs. The bill directs the appointment of three naval officers to serve as a board to locate a suitable site, and it is provided that work on the erection of the buildings shall begin within six months after the approval of the bill by the President. Senator Tillman, chairman of the committee, states that he is in sympathy with the provisions of the bill. Secretary Daniels of the Navy Department last week announced his intention of making an investigation of armor plate and ordnance making on account of the similarity of the bids of manufacturers and the division of contracts among them.

The Van Dorn & Dutton Expansion

The incorporation of the Van Dorn Electrical Tool Company, Cleveland, Ohio, with a capital stock of $300,000, to make the line of portable electrically driven drills and reamers now made by the Van Dorn & Dutton Company of that city, was recently noted in these columns. In addition to the Van Dorn & Dutton interests three St. Louis men are associated financially in the new company, namely, George D. Barnard, George Gannett, and W. P. Johnston of George D. Barnard & Co., of that city. The officers of the new company are: W. P. Johnston, president and treasurer, who will also be the manager; F. G. Hodell, vice-president, and H. A. Rock, secretary. Franklin Schneider will continue to supervise the manufacture and design of the company's products. No change is being made in the organization of the Van Dorn & Dutton Company, now comprising J. H. Van Dorn, president; H. H. Hodell, vice-president; F. W. Sinram, secretary and treasurer, and Franklin Schneider, manager and chief engineer.

The Van Dorn & Dutton Company has for about 18 years specialized in the production of gears and gear cutting. The company has always aimed to be thoroughly progressive and its facilities in this connection include a hardening department with the latest appliances. Its products include railroad motor gears and pinions and automobile, machinery, mill and other types of gears, while it is prepared to furnish on specifications machined or cut gears of all kinds, including bevel, spur, spiral, mitre, worm and rack.

About seven years ago the company took up as a side line the manufacture of its portable electrically operated drilling and reaming machines to which have since been added electric grinders, these being known to the trade as the Hard Service line. Within the last two or three years this line has been greatly improved, and the volume of sales has grown rapidly. Growth in the gear department has kept pace with the tool department. Because of this expansion it has been decided that the interests of both departments could best be served by operating each as a separate company.

Alabama Wire Plant to Be Completed

The Finance Committee of the United States Steel Corporation held a special meeting on Wednesday, May 21, at which it was decided to proceed with the work of completing and equipping the new wire mills of the American Steel & Wire Company at Fairfield, near Ensley, Ala. This work was stopped early in 1911 and machinery which had been ordered was put in use at other plants or stored. It is estimated that about $800,000 will be expended to put the mills in shape to start, and it will probably be late in the year before they will be in operation. The capacity is 450 tons a day of wire products. Billets will be obtained from the nearby Ensley steel works of the Tennessee company. The rod mill had been completed and the power equipment installed before the order was given to suspend work. Chiefly what is now to be done is the erection of manufacturing equipment. The work is in charge of C. W. Lutz.

National Eight Hour Law Pamphlet

The Treasury Department, Washington, D. C., through the office of the Supervising Architect, has issued a 16-page pamphlet for the instruction of those who are interested in the application of the national eight-hour laws. The pamphlet gives the full text of the law approved August 1, 1892, and the law approved June 19, 1912. Following are the opinions rendered by George W. Wickersham, Attorney General, August 19, 1912; by W. T. Thompson, Solicitor of the Treasury, December 11, 1912; others by the same officer December 17 and 24, 1912; others by George W. Wickersham January 21 and 22, 1913; another by W. T. Thompson, February 25, 1913; one by J. C. McReynolds, Attorney General, March 14, 1913; one by J. A. Fowler, assistant to the Attorney General, March 19, 1913.

This document has been brought out for the purpose of covering inquiries which are being received by the Supervising Architect relative to materials entering into the construction of public buildings.

Personal

Charles A. Carels, the chairman of the board of directors of Carels Frères, Ghent, Belgium, known as the largest exclusive builders of Diesel engines in Europe, has arrived in New York. In conjunction with the firm's United States representative, W. R. Haynie, 30 Church street, New York, he will investigate the matter of development and building of the Carels type of Diesel engine in this country. Mr. Carels will be in the United States for several weeks and while here will make an extended trip, visiting some of the larger works and particularly the large tool works, including the Lodge & Shipley Machine Tool Company, and the Niles-Bement-Pond Company, who, as a matter of interest, have furnished the majority of the tools in the Carels Frères large works at Ghent. That plant, at present directed by D. G. Baker, a well-known American engineer, is using largely American tools and through his efforts is introducing almost altogether American systems and processes of large production in the works.

Ambrose Beard, sales manager of the West Penn Steel Company, Brackenridge, Pa., has returned from Europe.

R. S. Utley, Pittsburgh manager of the Penn Machinery & Equipment Company, Oliver Building, Pittsburgh, has resigned to accept a position with the Aberdeen Lumber Company of that city. He is succeeded by Maxwell W. Scott, formerly connected with the Commonwealth Electric & Supply Company, Pittsburgh.

Charles M. Schwab sailed for Europe May 27, for an absence of three weeks.

Dean Hermann Schneider, head of the college of engineering, University of Cincinnati, has been selected as the third arbitrator in the dispute between the Cincinnati Traction Company and its conductors and motormen.

Joseph G. Butler, Jr., vice-president of the Brier Hill Steel Company, Youngstown, Ohio, has been re-elected president of the Youngstown Chamber of Commerce.

James R. Vandyck, Vandyck-Churchill Company, New York, sailed for Europe May 27. He will be abroad two months, visiting England and the Continent on pleasure and business.

S. H. Chauvenet has resigned as manager of the Berkshire Iron Works, Sheridan, Pa.

The following are the latest additions to the membership of the American Iron and Steel Institute: Clark D. Eaton, New York, eastern sales agent American Car & Foundry Company; William H. Farrell, Bridgeport, Conn., president Bridgeport Screw Company; George C. Mackenzie, Ottawa, Can., chief engineer ore dressing and metallurgical division, mines branch, department of mines, Ottawa, Can.; Richard H. Rice, New York, engineer General Electric Company; Luther A. Roby, Cleveland, superintendent steel department Wellman-Seaver-Morgan Company; James H. Ward, New York, assistant to chairman Bethlehem Steel Corporation; Robert G. Wells, Hamilton, Ont., manager Hamilton Works, Steel Company of Canada.

Axel Levedahl, chief engineer of the Independent Pneumatic Tool Company, Aurora, Ill., sailed from New York for a European trip May 21. While abroad he will visit prominent ship yards anad manufacturing establishments.

Clay Sprecher, for a number of years associated with the Allis-Chalmers Company as sales engineer, with Arthur G. McKee, blast furnace engineer, and later with the Elliott Company, Pittsburgh, has been appointed Pittsburgh sales manager for the C. & G. Cooper Company, engine builder, Mt. Vernon, Ohio, with office at 1323 Oliver Building. In addition, he is looking after the Chapman Engineering Company's sales of rotary gas producers, which are built in the Cooper Company's works.

Norman Flowers, Jackson, Mich., has resigned as secretary of the Jackson Chamber of Commerce, to accept the position of sales manager of the American Gear Company of that city.

Samuel B. Sheldon, formerly connected with the Lackawanna Steel Company and afterward with the Bethlehem Steel Company, has been appointed general superintendent of the Minnesota Steel Company, Duluth, Minn.

J. E. Moody, formerly superintendent of the piano plate department of the Home Stove Works, Chicago, which business was sold out to the Paragon Foundries Company, is now representing the Moller & Schumann Company, varnish maker, Brooklyn, N. Y., as salesman, with headquarters at the company's branch in Chicago.

W. E. Ellenberger, formerly interested in the manufacturing of industrial equipment, Cleveland, Ohio, and later the head of the Ellenberger Engineering Company of that city, has become connected with the Mineral Ridge Mfg. Company, Mineral Ridge, Ohio, as manager of its car department.

H. J. Bradner, Lees-Bradner Company, Cleveland, Ohio, has gone to Europe for a six months' business trip.

J. W. H. Hamilton, of Hamilton & Hansel, consulting engineers, New York, sailed on the Olympic May 24 for an absence of three or four months in Europe. He will supervise the starting up of a Greenawalt iron ore sintering plant in Italy and will assist in the laying out of similar plants in other European countries.

Obituary

Dr. ELMER E. BROWN, of E. E. Brown & Co., manufacturers of sash weights, Philadelphia, Pa., died at his home in that city May 23, after an illness of several months. He was born at Rising Sun, Md., in 1861, and attended school at Mt. Joy, Pa. In 1881 he went to Philadelphia, obtaining employment with Hoopes & Townsend and later with the Armbruster Sash Weight Company. In 1886 he began the manufacture of sash weights under the style of E. E. Brown & Co. While conducting this business he took up the study of medicine in Jefferson Medical College and was graduated in 1897, but did not practice. At the time of his death he was president of the Buchanan Foundry Company, Lebanon, Pa., a director of the Waterbury Foundry Company, Waterbury, Conn., and a member of the Philadelphia Hardware Merchants' & Manufacturers' Association. He had been president for many years of the late National Sash Weight Association and was vice-president of the Philadelphia Foundrymen's Association, a director in the Quaker City National Bank and three fire insurance companies, namely, the Peoples National, United Firemen and Independent. For the past seven years he has given considerable attention to educational work, being vice-president of Temple University. He leaves a widow and two sons, Clarence R. and Harold Brown.

JOHN T. BROWN, for some years vice-president and general manager of the Damascus Bronze Company, Pittsburgh, died at his home in that city May 20, aged 68 years. He was a well known metallurgist and is said to have been one of the first in this country to manufacture phosphor-bronze. He was a member of the Engineers' Society of Western Pennsylvania, Pittsburgh Railways Club and a life member of the Western Exposition Society of Pennsylvania. He leaves a widow, three sons and one daughter.

JAMES S. MARSHALL, the father of Charles D. Marshall, president McClintic-Marshall Construction Company, Pittsburgh, died at his home in that city recently, aged 73 years. He was purchasing agent of the company for 15 years.

British Pipe Contract Goes to France.—The French firm Société Anonyme des Hauts-Fourneaux, et Fonderies de Pont-a-Monsson has secured as lowest bidder the contract for the supply of cast-iron pipe required at the Hull works of the British Gaslight Company. This is commented upon rather freely by the journal of the gas interests, in view of the fact that some of the largest pipe foundries of England are close neighbors to the Hull works.

The assessment for Calumet Township, which is occupied mostly by the city of Gary, Ind., shows a property valuation of $23,300,000, a gain of $1,260,000 over last year. Five hundred new buildings were assessed this year. The valuation has increased $16,000,000 in four years. Gary is now the sixth city in Indiana in point of wealth.

The Marting Iron & Steel Company, Marting, Ohio, blew out its Etna furnace May 26 for repairs.

Pittsburgh and Vicinity Business Notes

The Imperial Company, Grove City, Pa., manufacturer of bronze faucets and cocks, has been reorganized. The death of J. J. Spearman of Sharpsville, Pa., and his son Ben Spearman, formerly owners of practically all the stock, caused some complications to arise and a receiver was appointed for the company pending a reorganization. The new officers are as follows: Mrs. Ruth B. Spearman, president; W. H. Christy, Bessemer Foundry Company, vice-president; A. R. Anderson, secretary-treasurer; J. M. Reynolds, sales manager, and John A. Nordstrom, superintendent. The plant is now in operation.

The Wheeling Mold & Foundry Company, Wheeling, W. Va., has nearly completed the extensive improvements which it has been making to its plant. A 20-ton crane of 55-ft. span now serves the furnaces and foundry. A new roll shop was built to separate the roll work from the general machine shop work and to make room for new machines in the machine shop. A 30-ton crane is being installed on a 600-ft. runway, over the casting storage yard, and an annealing furnace is to be added similar to that now in operation. New tools installed include a Bullard vertical turret lathe and a large gear hobbing machine.

Work has started on the building of a new electric street car line to run from Youngstown to Cleveland. Plans include the erection of a terminal station and depot and the construction of a 4000-ft. tunnel in Cleveland. The project is financed by a syndicate headed by W. S. Hayden, president Cleveland Chamber of Commerce.

The Westinghouse Electric & Mfg. Company, East Pittsburgh, last week made a shipment of 25 cars of machinery for Japan, via Tacoma, consigned to Takata & Co. at Tokio. The machinery is to be used in connection with the large water power development of the Inawashire Hydro-Electric Power Company about 145 miles from Tokio. The current will be transmitted to Tokio. The shipment consisted of eight 4000 kva. and four 150 kva. generators, O. I. W. C. transformers, two motor generator sets and switchboard material and is only one-third of the amount of apparatus for which the contract calls, the remainder being schedules for shipment in June and September.

The Latshaw-Bradley Machinery Company, Peoples Bank Building, Pittsburgh, has been appointed agent in that district for the Emery Machinery Company, Bradford, Pa., which manufactures gas engines and direct-connected gas-driven compressors from 30 to 100 h.p.

The George J. Hagan Company, Peoples Bank Building, Pittsburgh, has received a contract for the building of a number of sheet and pair furnaces for the Allegheny Steel Company, Brackenridge, Pa.

A. F. Plock, consulting engineer, Park Building, Pittsburgh, has placed contracts with the Variety Iron & Steel Works Company, Cleveland, for the steel work, and with the Louisville Fire Brick Company, Louisville, Ky., for the brick work for improvements to be made at the blast furnace plant of the Rockdale Iron Company, Rockdale, Tenn., comprising the erection of four hot blast stoves, hot blast main, cold blast main, bustle pipe and draft stack. The hot blast stoves will be of the White & Kernan type, 16 x 65 ft. The hot blast main will be equipped with Scott expansion joints. The draft stack will be 6 ft. inside diameter and 150 ft. high.

The Bessemer Motor Truck Company, Grove City, Pa., is now occupying its new plant, of which the main building is 60 x 340 ft., and is turning out motor trucks at the rate of two per day. It has made a shipment of four trucks to California.

The blast furnace of the Stewart Iron Company, Ltd., Sharpsville, Pa., which had to be blown out on account of the April flood, has been relined and repaired and will resume blast early in June. The stack usually runs on low phosphorus Bessemer iron.

The Bessemer & Lake Erie Railroad, controlled by the United States Steel Corporation, has ordered 14 locomotives from the American Locomotive Company and the Baldwin Locomotive Works.

The Riter-Conley Mfg. Company, Pittsburgh, has received a contract for a 10-story distillation building for the Solvay Process Company, Detroit, Mich., calling for 2100 tons of steel; also a contract from the Penn Traction Company, Wheeling, W. Va., for a self-supporting stack, 230 ft. high, requiring about 135 tons of plates.

The Pittsburgh Dental Laboratory Company, Pittsburgh, has been incorporated with a capital stock of $50,000, to manufacture dental implements. The incorporators are Clinton H. Stubbins, Frederick W. Deitz, Gordon T. Powell, Hill Burgwin and H. S. McKinley, all of Pittsburgh.

The German By-Product Plant at Bethlehem

Some interesting data bearing on the German by-product coke plant at the Bethlehem Steel Company's works were brought out on May 15 at the annual meeting of the builders of the plant, the Stettiner Chamotte Fabrik vormals Didier, the Stettin Refractory Products Works, successors to Didier, of Stettin, Germany. The manager of the plant, Drory, who had only just returned from Bethlehem, reported that the contract called for the completion of the coke plant in the beginning of August, 1912. This had been rendered impossible by a fire at the American works. Only now has the last of the four batteries of 75 coke ovens been put in operation. The three batteries do not yet furnish the quantity called for by the contract. In spite of all efforts to carry them up to a higher yield, it seems necessary to build an additional number of ovens in order to make sure that the daily product required by the contract is attained under the most unfavorable conditions.

The contract provides that "acts of God" release the company from liability for damages due to delay in completion of the plant. Fire is distinctly enumerated as such a cause. Therefore the company cannot be held responsible for delay in completion caused by the fire in the works of the concern furnishing the material; but it is a different matter with the inadequate capacity of the plant. By reason of the difficult legal and technical questions involved, the management must abstain from entering into details. In addition it was stated that the president of the Lehigh Coke Company has just arrived in Berlin from the United States in order to negotiate for a settlement with the company, with the associated Berlin-Anhaltische Maschinenbau A. G. and the stockholders of the Lehigh Coke Company, by which the risk of the Stettin company is lessened, and the possibility is brought about that through alterations in the ovens the loss to the Stettin company and the Berlin-Anhaltische Company is avoided. It may be stated that the two latter companies have been working under a 30-year contract of community of interests which dates from 1906.

The report states that the basis of the business remains excellent, as it has been in the past. The conditions of the supply of coal and the price for coke in connection with the utilization of the by-products are advantageous. The estimated cost of construction is to be paid in cash by the company in installments as the building progresses, so that it cannot be assumed that there will be a financial risk. The profit of the Stettin company consisted of a considerable block of common stock of the Lehigh Coke Company, obtained free of cost, and the profitable character of which is assumed to be certain. But through the fire and the delay the cost of the plant had been considerably increased. To meet this danger the Stettin company has considered its holdings of common shares as a reserve. The management of the Stettin company desires, through an arrangement with the holders of the stock, to acquire the shares of the Lehigh Coke Company and to refund the cost of that acquisition out of the profits. The management is convinced that by such a course the business will yield advantages to the Stettin company at a later time. Whether the plan can be carried out depends upon whether the holders of stock demand in addition to the cost price of that stock a share in the possible profits after covering interest and sinking fund.

There were some sharp criticisms of the management, but ultimately the year's accounts were passed and a dividend of 11 per cent. was declared.

Westinghouse Electric & Mfg. Company

Report for Fiscal Year Shows Earnings Nearly $40,000,000, Largest Ever Made

The annual report of the Westinghouse Electric & Mfg. Company, covering the results of the year ended March 31, 1913, presents the following statement of gross earnings and net income:

	Year ended March 31, 1912.	1913.
Gross earnings—Sales billed	$34,196,446	$39,977,565
Cost of sales—Includes all selling, administration and general expenses	30,604,850	35,406,293
Net manufacturing profits	$3,591,596	$4,571,272
Other income	1,160,442	996,564
Gross income from all sources	$4,752,638	$5,567,836
Less—Inventory adjustments, inactive apparatus and material scrapped, bad accounts and extraordinary items of expense charged to income	708,917	791,388
Net income applicable to interest and other charges	$4,043,121	$4,776,448
Interest charges	1,599,028	1,612,416
Net income available for dividends and other purposes	$2,444,093	$3,164,032

The consolidated general balance sheet of the company and its subsidiaries in the United States, as of March 31, 1913, is as follows:

Assets.

Factory plants—Real estate, buildings, equipment, etc.		$20,467,224.74
Sinking fund		160.20
Investments in stocks, bonds, etc., including those of affiliated European and Canadian companies		23,882,860.54
Cash		5,259,335.49
Cash on deposit to pay interest coupons and dividends		99,606.76
Cash on deposit for redemption of four-year notes due January 1, 1913		5,500.00
Notes receivable		3,796,941.06
Accounts receivable		8,920,820.19
Due from subscribers to capital stock		44,788.03
Raw materials and supplies, work in progress, etc.		18,510,222.56
Patents, charters and franchises		6,124,123.92
Insurance, taxes, etc., paid in advance		74,071.11
Deferred charge—Expenses incidental to issue of bonds and notes		813,333.33
Total		$87,998,987.93

Liabilities.

Preferred stock		$3,998,700.00
Common stock issued	$35,193,237.50	
In treasury	1,507,050.00	36,700,287.50
Convertible sinking fund, 5% gold bonds, due January 1, 1931:		
Outstanding	$19,504,000.00	
In treasury	758,000.00	20,262,000.00
Debenture certificates, due July 1, 1913:		
Outstanding	$1,390,000.00	
In treasury	150,000.00	1,540,000.00
Bonds—Walker Company, due January 1, 1916, guaranteed by W. E. & M. Co.		850,000.00
Total funded debt		$22,652,000.00
Collateral notes, due June 23, 1913	$2,000,000.00	
Collateral notes, due August 1, 1913	4,000,000.00	
Collateral notes, due Sept. 27, 1913	1,500,000.00	
Collateral notes, due October 1, 1917	2,720,000.00	
Total collateral notes		$10,220,000.00
Four-year notes, due January 1, 1913	$5,500.00	
Five-year notes, due January 1, 1914	429,500.00	
Six-year notes, due January 1, 1915	425,500.00	
Fifteen-year notes, due January 1, 1924	98,750.00	
Total long-term notes		959,250.00
Real estate purchase money mortgages		483,000.00
Syndicate agreement—Note and account, due July 1, 1913		300,000.00
Accounts payable	$3,361,359.26	
Interest, taxes, royalties, etc., accrued, not due	559,752.29	
Subscription, stock—Canadian Westinghouse Co., Ltd.	60,850.00	
Dividend on preferred stock, payable April 15, 1913	69,977.25	
Dividend on common stock, payable April 30, 1913	351,469.00	
Unpaid interest coupons and dividends	99,606.76	
Total current liabilities		4,503,014.56
Reserve—For adjustments of inventories, notes and accounts receivable, etc.		834,213.73
Profit and loss—Surplus		7,348,522.14
Total		$87,998,987.93

The sales billed for the year were in excess of any previous year in the history of the company. The ratio of the manufacturing profit to sales billed increased over last year, but unusually keen competition prevailed and still continues.

The value of unfilled orders as of March 31, 1912, was $8,137,961; as of March 31, 1913, it was $12,061,473. The average number of employees during the year was 20,542, as compared with an average of 16,000 for the previous year.

During the year the Canadian Westinghouse Company, Ltd., made an issue of additional capital stock, to which this company subscribed for its pro rata amount, $243,400, at par, all of which has been paid for except $60,850 due under the terms of subscription on May 1, 1913. The Canadian Westinghouse Company, Ltd., is paying cash dividends at the rate of 9 per cent. per annum in addition to adding a considerable sum each year to its surplus.

The increase in the capital stock of the Westinghouse Metallfaden-Gluhlampenfabrik Gesellschaft, m.b.H., represents a stock dividend received during the past year and the item of capital stock of the Compagnie des Lampes à Filament Metallique represents an exchange of the shares of the Westinghouse Metal Filament Lamp Company, Ltd., of London (a patent holding company) for the shares of the former which is a lamp manufacturing company operating factories near Paris, France, and in Aarau, Switzerland.

The capital stock of the Westinghouse Electric Company, Ltd., of London, has been depreciated to the nominal value of $1. This is a patent holding company all of the capital stock of which is owned by this company. It also acts as agent and trustee for this company. During the year its expenses have been reduced to nominal expenses for office rent and patent fees.

In general, the affairs of the other foreign companies, with the exception of the Russian company, show further improvement during the year 1912. The British and French companies particularly give promise of continued improvement. During 1912 the Italian company received large orders from the Italian Government for electric locomotives and other equipment, on which deliveries will shortly begin. The locomotives are duplicates of those ordered on previous contracts, which have proved successful in operation.

After an exhaustive investigation made upon the ground by the chairman and certain other officers of this company last autumn, the directors determined upon the liquidation of the Russian company, and have proceeded as rapidly as possible in carrying out the plan. The works have been sold and the collection of its accounts and payment of its debts are proceeding as rapidly as possible. It is anticipated that when its affairs are finally closed up, there will be a further depreciation of approximately $1,500,000, which will mean that this company will receive practically the amount of its current claims against the Russian company, and that its investment in securities of that company will be entirely charged off.

The company, together with Stone & Webster, the Equitable Trust Company of New York and William Morris Imbrie & Co., each taking a quarter interest, acquired the Westinghouse Machine Company's holdings in the Electric Properties Company, which was the controlling interest. The Electric Properties Company owns the entire capital stock of Westinghouse, Church, Kerr & Co., and was organized originally as an ally of the Westinghouse interests.

During December, 1912, and March, 1913, the company borrowed, with treasury securities as collateral, $3,500,000 on notes maturing in June and September, 1913. On August 1, 1913, the issue of $4,000,000 three-year collateral notes made August 1, 1910, will become due. The directors are considering plans to provide for these maturities which are expected to considerably reduce their amount.

At the request of the estate of Jawood Lukens, principal stockholder of the Longmead Iron Company, Conshohocken, Pa., Lewis N. Lukens and Louis M. Childs have been appointed receivers of the company. The plant, which is equipped for the manufacture of muck bar, skelp and small sizes of wrought iron pipe, has been idle for nearly two years.

The Steel Corporation Dissolution Suit

Cross-Examination of Charles M. Schwab and James A. Farrell by Government Attorneys—Farrell's Statistics Attacked

At the hearing on Wednesday, May 21, Mr. Schwab stated that the date of the dinner at which he outlined the advantages of a combination in the steel and iron industry was December 12, 1900, instead of some time in November, 1899, as he had erroneously given the date in previous testimony. The significance of this is in the contention of the Government that the Steel Corporation was formed to suppress competition.

The Carnegie Plans to Make Tube

The correction thus made put the dinner a month subsequent to Mr. Schwab's visit at the offices of J. P. Morgan & Co., when Charles Steele, one of the partners, told him of their alarm at the plans of the Carnegie Steel Company to erect a tube mill of very large capacity at Conneaut, Ohio, in direct competition with the National Tube Company, in which the Morgan interests were predominant. Later in the day Mr. Lindabury, counsel for the corporation, brought out from Mr. Schwab that he had urged and discussed the tube mill project for at least three years prior to the merger of the Carnegie Company into the Steel Corporation. He said: "I personally had engineers in my office, the president's office, although that was not in the line of my duty, preparing plans for tube work." There was therefore nothing new about it in the latter part of 1900.

Q. As far as you were informed in that connection, did the matter of the Carnegie's building a tube plant or going into any new enterprises have any influence? A. In my talks with Mr. Morgan upon these subjects that was not the argument or the theory that was expounded to him and these questions did not come up for discussion. I talked almost exclusively to him upon the economic advantages to be obtained by this consolidation. That was the only thing that I was thoroughly familiar with, and it was upon that basis that I presented it to Mr. Morgan. I did not mention the scheme of the Carnegie Company going into these finished materials to Mr. Morgan or any of his partners, to Mr. Gary or to Mr. Gates, neither did they mention it to me.

Taking up again the sequence of the testimony, Mr. Schwab was asked whether or not a holding company was part of the plan he suggested to Mr. Morgan, to which he replied: "I do not recall that Mr. Morgan and I discussed the method of doing it." Asked if he discussed with Mr. Morgan the amount of ore that he considered would be brought in under the combination, he answered: "I do not think he asked me any such question. I think he assumed from what I said to him that the various companies had sufficient ore to operate as an economical manufacturing plant."

Q. You spoke about an awkward position occurring if the price of rails was reduced. What did you mean? A. For example, supposing the Pennsylvania Steel Company reduced the price of rails to the Lehigh Valley Railroad, on which road my works is located. The president of the Lehigh Valley would be in an awkward position to go and buy his rails at a less price from a concern not on his road than he would from me, and he would be in a very awkward position not to buy the rails at as cheap a price as he could get them.

The Question of Ore Reserves

After quoting some of his testimony before the Stanley Committee, in which he said it would be hard for new corporations to obtain certain ore reserves, Mr. Schwab was asked:

Would it not be impossible for another concern of equal strength and magnitude and facilities for carrying on foreign business as the United States Steel Corporation has to get the ores in this country? A. In this country I think it would from the ores now known.

Q. Was it possible to form in this country after 1901 any other concern as well equipped for carrying on export business? A. You might, as well equipped, but not to the same extent in my opinion.

Asked practically the same question again, Mr. Schwab said: "I only want to say that if I live and have money enough the Bethlehem Steel Company will ultimately make every product that the United States Steel Corporation makes."

Mr. Schwab explained testimony given before the Industrial Commission in 1901, saying: "What I do know and what I want to say is that I still believe that any corporation like the Steel Corporation, controlling 70 per cent. of the product, could not fix the price."

The $1 Valuation on Ore in the Ground

Mr. Schwab had reiterated his valuation on the ore reserve of the Steel Corporation at $1 a ton. Judge Dickinson forced the admission from him that he knew of no transaction in ore at any such price as this. The minutes of the Carnegie Steel Company of June 6, 1899, were read, which showed that a committee composed of Mr. Schwab, Mr. Curry and Mr. Gayley had reported: "We estimate that the minimum quantity of ore in this mine is 50,000,000 tons, so that this ore cost us 2½c per ton in the ground, as compared with 25c per ton now beyond our leasehold."

Q. You have no recollection of that transaction? A. No, I really have not.

Q. There were ores to sell, were there not, after the corporation was formed and none of them that you ever heard of that had a selling or leasing price during the time you were with the corporation went at $1 a ton? A. No; but do you realize that it would not be possible to have such a collection of ores of various kinds for steel making located as advantageously as these ores and that so well suited the purpose as these ores, the acquisition of which would not have been possible at any other time or under any other circumstances, and, therefore, had none of the conditions that would make this body of ore valuable by reason of its contiguity, analyses and mixtures for steel making purposes?

Mr. Dickinson: I will be pleasant enough to be cross-examined and say "yes." I do realize it and that is just what I am coming to. Was not your estimate of the value placed upon that ore in combination and upon the understanding that you could not go out into the market and duplicate it? A. No; if I had an opportunity of purchasing ten mines, located at different places, I would not pay nearly as much for them as if I had these mines located so that I could operate them to the best advantage. And, therefore, when you speak of an isolated case, like a mine on the edge of the range, for example, leasing at a less price, it probably was not worth more than that price. But, to be clear, I want to state again that the estimate of $1 a ton placed upon that ore was my own personal opinion of its value, from which I have never seen fit to change, and which, while it might have seemed high in that day, it has been more than justified by the development that I predicted by this time.

Q. I ask you whether or not these ore properties, if put upon the market at that time by a corporation wanting to sell, and sell separately to purchasers wanting to buy, would have commanded a price of $1 a ton in the ground? A. I could not say that.

Q. And you do not mean to say that by anything you have said as to the dollar valuation? A. No.

The Defense Gets in Tributes to the Corporation

Judge Dickinson excused Mr. Schwab from further examination and Mr. Lindabury began his re-direct examination, reading from a speech made before the Bankers' Association in 1901 what Mr. Schwab had said at that time about the large proportion of ores in the Lake Superior district owned by the Steel Corporation. Mr. Lindabury placed in the records the whole of the speech as intended to show the inevitable progress of combination formed on correct economic lines, the good relations of labor, the steadying effect on business and increased confidence resulting. He also read into the records a portion of Mr. Schwab's testimony before the Industrial Commission May 11, 1901, in which he told of the economy and efficiency resulting from the combination of the properties that went into the Steel Corporation.

Asked about the policy of the Steel Corporation while he was president, Mr. Schwab said: "I think the policy we adopted in the early days of the Steel Corporation of

making known our prices, of steadying those prices and treating in open fairness our customers and competitors gradually resulted in better feeling and more confidence between the steel manufacturers."

Q. It appears by the records in evidence that the price of steel rails, at one time $28, went to $38 and $26, and then after the corporation was formed, in May, 1901, it was put up to $28 and has remained at that price even since. Was that price of $28 per ton fixed in 1901 as the result of any combination or agreement among manufacturers? A. I think not.

Bethlehem Has Offered $1 for Ore without Getting It

Q. You spoke in your examination of having offered $1 a ton for ore within a few weeks and having that offer refused. Where was that located? A. Port Henry, N. Y.

Q. To whom was the offer made? Who was the owner? A. Witherbee, Sherman & Co.

Q. Tell how much it will cost to export your ore from Chile to New York? A. From $2.25 to $2.50, including the Panama tolls.

Q. How high does the metallic contents of that Chilean ore run? A. Sixty-eight per cent. iron.

Q. How far is it from the ocean? A. Four miles, and down hill.

Q. Is stripping required? A. None whatever.

Q. What will be the total cost per ton in Chile of mining and delivering ore to the boat? A. $1 a ton.

Q. At what price over all can you mine, transport and deliver that ore at Bethlehem? A. Six cents a unit, or $4.08 a ton.

President Farrell Cross-Examined on Special Contracts

Judge Dickinson, on Thursday, attacked President Farrell's statement that since the formation of the corporation its policy had been to make public its steel prices, that there was no secrecy to those interested and that prices were maintained without preference.

Q. Did not the corporation have a secret agreement with the Harriman Lines by which straight preferential prices were given to those lines? A. No. We had no secret agreement. I know that some of our companies made contracts with these various companies, and I think they have made contracts with the lines on the so-called Harriman system. These contracts, as I recall it, take the average price of the market as a settling price.

Q. Do these contracts give the Harriman Lines preference? A. No. I would not regard that as a good contract myself. If I had been the purchasing agent of the Harriman Lines I would not have made such a contract with the Steel Corporation, for the reason that it took an average price over a period. The contracts were distributed among our own managers in all directions, and I would never regard it of a secret character.

The American Can Company's Contract

Answering questions in regard to the contract of the American Sheet & Tin Plate Company with the American Can Company, Mr. Farrell said: "The American Can Company is the largest purchaser of tin plate of any single consuming interest in the world. It buys 6,000,000 boxes of tin plate per annum, in round numbers 300,000 tons, practically three-fifths of the output of the tin mills of the American Sheet & Tin Plate Company, and because of the quantity it is treated the same as any other large buyer; it is given a price a little lower than it would be to a buyer of a ton of tin plate."

Judge Dickinson brought out that the contract with the American Can Company tied it up to take the bulk of its requirements from the Steel Corporation's subsidiary, but while he said the contract calls for 99 per cent. of the Can Company's requirements, he was unable to verify this from the witness. Although not generally known, Mr. Farrell said he did not consider the contract secret because "a contract of that kind would be made with any large buyer of material," adding, "I think large buyers such as the Continental Can Company knew this contract."

Mr. Farrell said that the contract extended over a period of five years, beginning with 1907 or 1908, and that it had been revised and renewed several months ago.

Q. After the filing of this bill? A. Yes, but it had no connection with the filing of this bill.

Government Counsel Attacks Price Statements

Judge Dickinson attempted to prove that steel prices were higher when the steel suit was filed in 1911 than they were in 1904, and that Mr. Farrell's testimony that a constant decline of steel prices since the formation of the corporation was in error. Judge Dickinson brought out the prices of various important products.

Q. Does it show a constant decline? A. Not a constant decline. "Constant" is something like a toboggan; it does not show that.

Q. Is it not a fact that the prices in 1910 were higher than in 1904? A. Yes, and $2 lower in 1911, and $3 lower in 1912, but you do not take those years into consideration.

Judge Dickinson: No. I do not take those into consideration, because we think that some things began to happen after we filed the bill.

Mr. Farrell: Of course I have in mind the period over which we are doing business.

Judge Dickinson said he did not include 1911 in his comparison since he said 1911 included part of the year in which the steel suit was filed. After he took up the price of black sheets, Mr. Farrell said, "You do not keep on."

Judge Dickinson: I hate to show how much it has reduced after the filing of my petition.

Mr. Severance: I should think you would have been proud to have produced such a wonderful result, Judge.

Judge Dickinson: It would look like taking an unfair advantage.

Judge Dickinson took various tables of prices which had been prepared from trade papers and from the records of the Steel Corporation by men in the comptroller's office of the corporation, and, without allowing Mr. Farrell to refresh his memory in any way, asked him literally hundreds of questions as to the prices of certain products at certain times and freight rates between certain times on certain products for certain months in certain years. For example, "What were the freight rates on iron ore from Lake Erie port to the Mahoning and Shenango valleys on May 1, 1903?" and "In the month of April, 1901, were steel bars higher or lower than they were during the months of October, November and December, 1900?" Mr. Farrell, of course, did not attempt to reply to all the questions with exact answers.

Mr. Severance showed his extreme disapproval of the method of Judge Dickinson at one stage, saying, "Judge, what do you think he is, an *Iron Age*?" Mr. Severance gave notice that the clerks who made up the schedules would be called later to tell from what sources they were compiled and how.

The Corporation's Encouragement of Exports

Judge Dickinson then took up the special prices given to manufacturers who sent their goods outside of this country.

Q. If the thing were to go to foreigners they would get it at a less price than if they went to our own people? A. No; that is a mistaken idea. The foreigner pays more for his goods than the man in this country, when the duties and freight and everything are to be paid. For example, in the case of Australia, an article would have to carry a freight charge for 14,000 miles. We would not only sell at special prices to anybody that wanted to develop a foreign business, but we would lend him a salesman in a foreign country and place our office at his disposal, and help in every way to build up a foreign business.

Q. Now, how did you know that these things were going to be sold abroad? A. Well, we are generally furnished with a custom house bill of lading, showing their exportation.

Q. So you have official evidence of the fact? A. In that we are doing just what the Government does in permitting the railroads to make lower freight rates on material that is going abroad than on that for domestic consumption.

Q. You mean lower rail rates in connection with water freights? A. No. I mean rail rates between the same points.

Q. Do you mean to say that the Government, through the Interstate Commerce Commission, makes lower rates on goods for export than on goods for domestic consumption? A. Yes. It has been doing it since 1903.

It was evident that this was entirely unknown to the Government prosecutor, although Mr. Severance, counsel for the Steel Corporation, remarked that it was done by the Illinois Central, of which Judge Dickinson was general counsel before he became Secretary of War.

Continuing to Discredit President Farrell's Statistics

Judge Dickinson then asked a number of questions as to foreign export prices for specific dates without allowing the witness to examine the exhibit which had been submitted and from which Judge Dickinson was questioning him. For example, "Do you know the average price of spring steel as sold for export during 1904?" Mr. Farrell replied, "Not without refreshing my memory by examining the exhibit."

Judge Dickinson asked Mr. Farrell concerning his knowledge about percentages given in the exhibit. Mr. Severance called Judge Dickinson's attention to the fact that no percentages were given in that exhibit. "You are questioning him with respect to exhibit 41. It does not contain any percentages; it contains only dollars of increase per ton."

On Friday, Judge Dickinson again attacked Mr. Farrell's competency to testify as to the accuracy of figures he had submitted on previous days. A typical question asked was, "From your knowledge in your own mind, and independent of going back and preparing anything from data, either your own data or from Comptroller Filbert's, could you have given figures substantially like those for each of these years [tonnage of exports of iron and steel by the United States Steel Corporation], for each of these commodities without the actual report and without the actual figures?" Mr. Farrell answered:

No; I could not have done it out of my mind. No such statement can be prepared without a mass of figures, and I could not have done it any more than anybody else. I should say, from my knowledge of the business and my contact with the business, and the details which I am familiar with concerning the business, that those figures are substantially correct, because they comport with other figures which have been prepared from time to time in other offices, outside of the comptroller's office, in another office altogether in the Products Company, a company that does this foreign business, the only difference being that it deals in net tons and the comptroller deals in gross tons. The Products Company is a self-contained concern, and the figures are there, and it is something I was in touch with every day and am still in touch with.

With regard to this and the other corporation exhibits submitted while Mr. Farrell was directly examined, Judge Dickinson made exceptions such as "We except to defendant's exhibit No. 44 as being hearsay, secondary and incompetent, and we except to Mr. Farrell's testimony as to the correctness of the figures herein set forth or to their substantial accuracy."

A Question as to Cotton Ties

Judge Dickinson read from the minutes of the Carnegie Steel Company of January 27, 1903: "We have sold 1,200,000 bundles of cotton ties, although the market has been open only two weeks. Last year our total sales amounted to 1,300,000 bundles, but our allotment has been increased this year." And again, in regard to a contract made between the Steel Hoop Company and the Illinois Steel Company to pay the latter $150,000 per year to stay out of the cotton tie business, and that Mr. Corey and Mr. Schwab succeeded in having that agreement cancelled. Mr. Farrell said he knew nothing about the arrangement as to an allotment of business in cotton ties to the Carnegie Steel Company nor as to the agreement of the Illinois Steel Company to stay out of the cotton tie business.

Q. I believe you testified in your direct examination about the cotton tie business not being profitable? A. Yes, as compared with other commodities.

Q. Do you mean to say that they were not made at a profit? A. No; I didn't say so.

Judge Dickinson excepted to an exhibit prepared from Swank's Directory of the American Iron and Steel Association, in regard to the output of bars by the Steel Corporation and by competitors, because Mr. Farrell did not personally compare every figure with the originals in Swank's Directory and because Mr. Farrell said that he could not have made up the exhibit without the aid of that directory.

Export Figures Attacked

Judge Dickinson had Mr. Farrell read into the records statistics from the Bureau of Statistics of the Treasury Department for exports of iron and steel in 1896, 1897, 1898 and 1899, and a few statistics of 1900, 1901, and 1902. Judge Dickinson's object evidently was to prove that after the corporation was formed exports of pig iron decreased; for example, from 286,687 tons in 1900 to 81,211 tons in the following year and 27,480 tons in 1902.

Mr. Severance objected to this testimony as immaterial, because the testimony shows that the corporation was not a seller in those days of pig iron or an exporter.

Judge Dickinson asked in detail concerning the steel requirements of the International Harvester Company. Mr. Farrell replied that he could not state definitely, but it was generally understood in the trade that it was using about 150,000 tons a year. If there was a good crop it would use more than if the times were bad. Sometime before 1909 its subsidiary, the Wisconsin Steel Company, built a rolling mill and now rolls a great deal of its own material.

Q. How much did it get for any particular year from outside sources? A. I do not know. You see it depends a good deal upon the elasticity of its own production.

Asked about competitors of the Steel Corporation selling to the Harvester Company, Mr. Farrell said, "The Jones & Laughlin Steel Company and the Republic Iron & Steel Company. Jones & Laughlin generally got the business. We did not generally get much business from the Harvester Company."

Mr. Farrell said that besides the Carnegie Steel Company and the Illinois Steel Company, of the subsidiaries of the Steel Corporation, selling to the Harvester Company, the American Steel & Wire Company sold it wire for making springs of various kinds and that the American Sheet & Tin Plate Company sold it sheets.

Still Harping on Harvester Company's Relations

President Farrell at Monday's hearing denied that his company had favored the International Harvester Company on prices. Judge Dickinson sought to have Mr. Farrell admit that the company had a preferential contract with the Harvester Company and quoted from the minutes of the Carnegie Steel Company to show that a price had been made below the market. The witness declared this was not a preferential contract, but a matter of good salesmanship and said that there was no secrecy about the deal.

Judge Dickinson continued persistently to test the first-hand knowledge of Mr. Farrell. He continued also to register exceptions to the tables and statistics offered in evidence when Mr. Farrell testified on direct examination because the witness had to admit that he had not prepared all the figures himself, from first-hand sources.

The special exhibit for the defense under fire was No. 47, which set forth the output of the subsidiaries of the corporation over a period of years and all showed that during the same time competition by independents has grown. Judge Dickinson wanted to know about that directly from Mr. Farrell and in every case he could only answer that while he had general knowledge of the subject he had to take his figures from secondary sources.

Among several matters taken up were one as to special sales made by the Illinois Steel Company to the International Harvester Company in 1903; another was the purchase of the Shelby Steel Tube Company, which was described as "our only real competitor" at a meeting of the executive committee of the United States Steel Corporation, and a third was a special contract with the Harriman Lines for the delivery of between 10,000 and 15,000 tons of structural steel annually. This special contract was only one of a series with the Harriman Lines, some of which had been referred to before.

The Purchase of the Shelby Tube Company

Judge Dickinson resurrected the minutes of a meeting of the executive committee of the United States Steel Corporation, April 30, 1901, at which there were present Messrs. Gary, Schwab, Edenborn, Roberts and Converse.

It sets forth that Mr. Schwab, then president, reported the result of a meeting he had with Mr. Miller of the Shelby Steel Tube Company and stated that it was his opinion that it was not at "present feasible to make any division of the business of the National and Shelby steel tube companies. Upon the question of the acquisition of the property of that company Mr. Schwab stated that the stock outstanding amounted to $8,000,000 of common and $5,000,000 preferred stock. He is impressed with its earning power capacity and believes that under our control it would net about 50 per cent. He rather thinks that the whole property could be purchased for about $3,500,000. Mr. Converse stated that it is the only real competitor the National Tube Company has and that between the two companies all the patents for seamless tubing manufacture are owned."

Judge Dickinson asked Mr. Farrell how about that and the witness replied:

"My recollection is that there was competition, and my recollection also is that the Mannesmann Company of Germany, who are the biggest people in the seamless tube business, and who are building plants all over the world, now building a plant in Canada, I think were talking about coming here at that time, too."

Carnegie "Dumping" in Europe in 1894 and 1895

Judge Dickinson on Tuesday questioned Mr. Farrell in regard to the "dumping" of American steel in Europe, who said: "The Carnegie Steel Company sold largely, from 1894 or 1895, and at various times up to the formation of the corporation. That was the only company that attempted to do much of the business."

When Judge Dickinson pointed out the exports of rails in 1898 to have been 293,592 tons, Mr. Farrell said that a large part of this went to Canada to the Canadian Pacific Railroad. There was no duty on rails entering Canada until 1904. The Maryland Steel Company exported rails for the Eastern branch of the Canadian Pacific. Statistics submitted by Mr. Severance showed that in 1898-99-1900 180,460 tons of rails were shipped to Canada and 169,400 tons to Europe.

Mr. Farrell said of the results of the Carnegie Company's "dumping" steel in Europe: "It was endeavoring to dispose of large quantities of material while there was depression at home. In doing this, it dislocated those foreign markets; prices there were greatly demoralized. The manufacturers in those markets not only met the prices made by the Carnegie Steel Company, but made lower prices, and the result was that thousands of tons were not delivered by the Carnegie Company; and it was an actual fact that the buyers of its products paid the company to let them out of contracts after the market had been demoralized. I have examined the records in London myself, and they show that over $100,000 was paid to the Carnegie Company by buyers. Harland & Wolff paid $50,000 or $60,000."

Competition Matters

Asked what would be an appreciable amount of bars in 1900 sold in competition, Mr. Farrell said: "It would depend almost entirely on the location. A concern might be a small producer of bars at Laramie, Wyoming, and yet control the business there because of freights from Chicago to Laramie. There is a mill at Laramie. We would consider producers selling in competitive territory pretty fair competitors who produced 5000 to 10,000 tons, and 20,000 tons quite considerable."

Judge Dickinson asked if the cancellation in 1900 of the American Steel & Wire Company's billet contracts with the Carnegie Steel Company caused the latter to appropriate money to enter the wire business. Mr. Farrell replied that he was not able to answer. "They were always talking about going into everybody's business, but we never paid much attention to what they were saying, in the trade."

Mr. Farrell did not know that the Consolidated Steel & Wire Company had a contract with the Carnegie Company to stay out of the business, nor that the Carnegie Company had a girder rail mill and was paid to keep out of girder rail manufacture by the other companies.

The government then having concluded the cross-examination of Mr. Farrell, Mr. Severance took the witness on re-direct examination. Mr. Farrell said that steel prices in 1904 were in some instances $14 a ton lower than in 1901. Mr. Farrell was then excused. He had occupied the witness chair for eight days.

Mr. Joyce Next Testifies

Thomas W. Joyce, a clerk of J. P. Morgan & Co., was called to the witness chair. He testified that at Mr. Morgan's request he examined the books of Moore & Schley and found that they had 157,700 shares of the Tennessee Coal, Iron & Railroad Company on its books at the time of the panic in 1907. He found 36,000 shares were "free," i. e., unincumbered by loans. However, he did not see the actual certificates, as they were locked up in the vaults, and he did not go back of the books in his search.

He reported his findings to Mr. Morgan at his library and to Mr. Schley of Moore & Schley.

Chairman E. H. Gary Begins His Testimony

Judge Gary was next called and asked to tell how he became associated with the Steel Corporation. He traced his connections with the Consolidated Steel & Wire Company, the American Steel & Wire Company and Federal Steel Company, to the position he now occupies.

National Association of Manufacturers

The annual convention of the National Association of Manufacturers held at Detroit, Mich., May 19 to 21, was one of the best in the history of the association in the character of addresses delivered and in point of numbers present. Resolutions were passed touching upon various phases of the business situation, including a strong deliverance in favor of a tariff commission.

The labor question, as usual, received much attention from various speakers. H. E. Miles, Racine, Wis., criticised the common school system, extolling the work of industrial high schools but claiming that they could not reach enough children. John H. Leete, dean of the Carnegie Institute, Pittsburgh, delivered an address on "Industrial Education." A. H. Baldwin, chief of the Bureau of Foreign and Domestic Commerce, made an address in which he assured the manufacturers that Secretary Redfield of the Department of Commerce did not propose to antagonize them in making investigations of wage decreases as affected by the Underwood tariff. He is reported as saying that an investigation will only be made to get the facts so as to find some relation between the labor cost and the market cost here and abroad, thus really being a continuation of the work of the late Tariff Board.

John Kirby, Jr., the retiring president, was presented a check for $10,000 by Ludwig Nissen, New York, acting for the association, with the recommendation that it be used for the purchase of a country home. A banquet at the Hotel Pontchartrain was one of the closing features of the convention. At this banquet Prof. J. Laurence Laughlin, Chicago, made an address in which he said that the public pays for higher wages brought about by monopoly control of labor.

The election of officers was held on a train May 22, while the manufacturers were on their way from Detroit to Battle Creek, Mich., as guests of C. W. Post, to make an inspection of his plant at that place. It resulted in the choice of Col. George Pope, Pope Mfg. Company, Hartford, Conn., as president; George S. Boudinot, New York, secretary; A. B. See, New York, treasurer; J. Philip Bird, New York, general manager.

N. L. C. Kachelmacher, formerly president Bessie Ferrosilicon Company, Columbus, Ohio, has secured control of the properties of that company. The blast furnace at New Straitsville, Ohio, has been out of blast for several years. Plans for starting it up have not yet been decided upon.

The Gas Engine in the Steel Industry

(*Continued from page* 1305)

Taking Table IV, which gives a comparison of the cost of producing electric power in steam and gas power plants, it should be noted that of the eight steam turbine plants used by the author for comparison we have one station with a use or power factor of 33 1/3 per cent. The average use factor is 25 per cent. and the minimum use factor is 10 per cent. Comparing this with the blast furnace gas engine plants we find a use factor in one station of 71.5 per cent. The average is 49 per cent., and the minimum is 22 per cent. These figures show clearly as above stated the lack of uniformity in operating conditions in the stations under comparison.

The Case of the Smaller Blast Furnace Plants

The paper takes as a standard of comparison a large station. In fact, it discusses as the basis a plant containing eight furnaces. Such plants are extremely rare in the United States, and it would be very useful and illuminating to discuss the results which would be obtained if the plant contained only one, two or four furnaces. It is needless to state that on account of the variations in gas quality which result from operation of one or two furnaces the conditions of operation of the gas engine, either in the electric plant or in the boiler house, become extremely uncertain. Under these conditions no such recourse as firing of coal is available to the gas engine operator, whereas in the steam plant such coal firing is possible. In case of emergency with the furnace tight, with very little gas coming over, the ability to resort to coal firing is of vital importance. The situation therefore from this and other causes becomes greatly modified and the advantages of the steam station become enhanced as the plant decreases in size.

The steam turbine is not at the end of its development, and the rapid progress which has been made in the last few years is not the end of the story. We now have before us the possibilities contained in the utilization of higher steam pressures and higher superheats, and we have every reason to believe that by the utilization of such conditions 20 to 21 per cent. overall thermal efficiency of the station can be realized. Pressures up to 300 lb. are now being used in our navy without the slightest difficulty; and a boiler is now in operation in this country with 500 lb. pressure with success. There are also superheaters in use carrying as high as 1200 deg. temperature. The proposition, therefore, which has been made to utilize steam at 500 lb. pressure and 700 or 800 deg. temperature is not a wild or impracticable one, but one which is capable of realization without excessive development. Such pressures and temperatures are in no way analogous to the conditions in a Diesel engine cylinder where the pressures are attained with tremendous shock. Here the pressures are attained gradually and without shock, and the temperatures are absolutely under control. I, therefore, believe that a strong possibility exists that higher temperatures and pressures will be used with satisfaction and success in our power stations in the reasonable future.

The Savings with the Turbo Compressor

For turbo compressors the case rests on entirely different grounds. The real problem in this case is how best to blow the furnace. The blast furnace is operated, not primarily as a source of gas but as a source of pig iron; and the first necessity is to produce this pig iron in the largest possible quantity and of the most uniform quality, with the smallest consumption of coke.

Centrifugal compressors are more uniform in operation than any other method of blowing apparatus and measure the air more accurately than it has ever been done before. The savings resulting from this uniform operation and accurate measuring of air are similar to those due to any other method of securing uniformity in furnace conditions, such as sizing the charge, weighing the charge and using the dry blast. The results of the use of centrifugal compressors on blast furnaces are a greater output from the furnace in tons of pig iron per 24 hrs. and a lower coke ratio, and therefore a decrease in cost of iron due to the lower coke ratio and to the increased product which results without increase of labor cost. The results of the installation and operation of some considerable number of such units leads to the belief that an increased output of at least 10 per cent. will result from the use of such machines and that the decreased coke consumption per ton will be at least 10 per cent. It is expected that within the near future actual results in the operation of such machines as compared with other forms of blowing can be presented to the Institute.

If the saving above mentioned is realized the cost of iron will be reduced 40 cents per ton, with coke costing $4 per ton, and this is equivalent to $60,000 per year on a 450-ton furnace. Production of 10 per cent. extra tons of iron at a total manufacturing cost of $2 per ton, which would be saved since the product is obtained without increased labor cost, adds $30,000 to the saving. The total gain, therefore, becomes $90,000 per furnace per year.

Against this we must charge, if we assume the author's figures are correct (and they are much too high for turbo blowers) the total extra cost of operation of the turbo blower of $19,000, making a net saving of $71,000 per year per furnace, or for a complete plant of eight furnaces a total saving by the use of turbo blowers of $568,000 over the gas blower.

It would also be necessary to take into account the decreased amount of gas available, due to the use of the turbo blower, of 15 or 20 per cent. of the amount available for electric power purposes which at the maximum would amount to $19,000 per year per blower, or a total of $152,000 for the eight-furnace plant. If we deduct this figure from the $568,000 just mentioned we still have a saving in favor of the turbo blower of $416,000 per year. I expect to show later on, however, that the author greatly overestimates the difference in gas consumption between the turbo blower and the gas blowing engine.

Turbo Blower Expected to Improve Furnace Operation

So far as cost of installation is concerned, the turbo blower must be conceded to have the advantage; and so far as ease and flexibility of operation and accurate exact adjustment to meet and control furnace conditions is concerned it is pre-eminent. Furnace operators do not yet realize the possibilities connected with the operation of blast furnaces with an accurately measured rate of flow of air, which is afforded them by the use of the turbo blower. This accuracy is such that the rate of flow of air into the furnace can be determined and regulated within 5 per cent. at all times; and this regulation and accurate control of the air will, I believe, lead to great improvements in the operation of blast furnaces. It seems to me that it is analogous to the advantages in connection with electrical apparatus gained by our ability to accurately measure the power consumed. Too much emphasis cannot be put on the unchanging conditions of blowing obtainable and the maintenance of efficiency over an extended period without constant care and overhauling, which are characteristics of blowing by turbo compressors.

Comparison is made of the relative costs of operating turbo blowers as contrasted with blast furnaces where the price of coal changes. Considering the savings to be made in coke the cost of which will follow closely the changes in cost of coal, it would seem that these two factors tend to cancel each other and that the turbo blower still retains its desirability whether with high or with low cost of fuel. All the arguments in favor of the turbo blower in large furnace plants above set forth are concentrated and increased in potency as the plant becomes smaller, and there can be no competition between the turbo blower and the gas engine for plants of one or two furnace capacity.

Closure of the Discussion*

Type of Gas Engine and Plant and the Steam Turbo Compressor

Mr. West's figures giving installation costs of gas, electric and gas blowing engines at the Bethlehem plant, if embracing the same items which enter the installation cost of the corporation plants, are apparently lower than the latter. The corporation plants under discussion were built several years ago without previous experience, whereas the

*From Mr. Freyn's closure to the discussion on his paper read before the American Iron and Steel Institute.

Bethlehem Steel Company had at its disposition the large experience of the United States Steel Corporation plants, and could thus design and build its plants in a much more economical way. The machinery was furthermore built at the Bethlehem plant itself, thus eliminating among other things the expense for freight, which in view of the great weight of gas engines is no small item. The Gary plant was almost entirely built by contractors, since no machine shop and no other facilities existed. Thus the cost figures given by me include the profits of the contractors. On account of the condition of the soil a great deal of expensive piling had to be done at Gary. The gas cleaning plant at Gary I believe is the very cheapest gas cleaning plant in existence using Theisen washers.

The Proportion of Reserve Units

It is unquestionably true that the installation of two single tandem gas blowing engines is cheaper per blast furnace than that of 1½ twin tandem engines, but Mr. West compares the cost of 16 twin tandem blowers with that of only 18 single tandem units, and overlooks the fact that at Gary 25 per cent. of the total units installed is held for spare, whereas in his assumed plant only 11 per cent. in spare units is considered. If similar assumptions are made with reference to the proportion of spare units at the Gary plant, which Mr. West claims to be quite satisfactory at Bethlehem, then at least two of the Gary twin tandem blowers could be omitted, and the total cost of installation of the Gary blowing engines would then be roughly $\frac{14}{16} \times 3{,}105{,}000 = \$2{,}700{,}000$. The percentage of investment—using Mr. West's own figures—would then be 100 per cent. for the Gary plant, and about 65 per cent.—instead of 56 per cent.—for the Bethlehem plant.

It is very doubtful whether all blast furnace managers would agree with Mr. West, that one spare unit for eight operating units is sufficient, as no other blast furnace and steel plant in this country enjoys the great advantage of having engine works operated in conjunction with a steel mill, where the gas engines are built, and where repairs of the engine equipment can be made very easily and promptly. Be this as it may, the only correct basis for comparison is the required number of "operating engines." In other words 12 twin tandem blowers at Gary must be compared with 16 single tandem blowers at the Bethlehem plant.

I make these statements merely to correct possible misapprehension on the part of the readers; in principle I fully and heartily agree with Mr. West that the single tandem arrangement is preferable. This arrangement is in no way new, and in fact it represents the type of blowing engine used in Europe exclusively for blast furnace purposes.

Why Twin Tandem Blowers Were Used at Gary

The reason why the United States Steel Corporation plants were equipped with twin tandem blowers is simply that at the time of installing these engines several years ago, blast furnace superintendents insisted on having gas blowing engines capable of delivering the full quantity of blast at the extremely high pressure of 30 lb. per square inch. This condition could even today not be fulfilled unless twin tandem gas blowing engines are installed. It is recognized today that it is quite sufficient to blow a reduced quantity of air in the extremely rare cases when the high pressure of 30 lb. is necessary. Some blast furnace managers indeed claim that a maximum of 25 lb. is fully adequate for all purposes of blast furnace operation.

In Table C Mr. West shows that the cost of 1,000,000 cu. ft. of blast at the Bethlehem plant is less than at Gary. Mr. West admits that his figures cover a period of only five months of operation. I personally consider the Gary figures more valuable as an operating record, because the Gary plant has been in operation for five years. In a new plant which has been in operation only a short time, the expenses for repairs are naturally a good deal lower than in a plant which operated for several years. I should also point out that the labor is cheaper at South Bethlehem than at Gary. There cannot be any question that the Gary figures for installation and operation costs would be much improved if this plant had been built only recently, using the latest improved type of single tandem gas blowing engines, as now built by a number of gas engine manufacturers in this country.

Efficiencies and Power Factor

With reference to Mr. Rice's discussion, I wish to point out that the figures given in my paper are actual operating results obtained with blast furnace gas engine and steam turbine plants in this country in the recent past. While the steam plants have been in use for some time, the same argument applies on the gas engine plants. In giving information on what has been actually done to date, I did not mean to convey the impression that better results could not be obtained in the future.

I have explained at length in my paper the great influence which the personal equation of the operator has upon results in steam power plants, and thus I cannot agree with Mr. Rice that it should be possible in the future to obtain thermal efficiencies of 15.5 or even of 13.5 per cent. in commercial steel mill practice. In this connection it may be of interest to mention that the average boiler efficiency in twelve large boiler plants in American steel mills was only 60.5 per cent. in 1911.

As regards the argument which Mr. Rice advances concerning improved thermal efficiency of steam plants with better use factor and higher loads it is said to be one of the advantages of steam turbine equipment that the steam consumption curve is extremely flat. If this contention is true the thermal efficiency at greater load will not be materially better than that at fractional load.

Concerning the cost of installation of turbine stations, I must refer to the information given me by practical mill men and by power plant engineers who have installed such plants, and which indicates that this cost would be near the figure given in my paper, namely, $70 per kw.

Uniform Air Supply as Affecting Furnace Operation

Mr. Rice lays considerable stress on the alleged saving in coke consumption and increase of pig iron production due to the uniformity of the air supplied by turbo blowers. In my opinion, which is corroborated by prominent blast furnace men, this claim could hardly be substantiated; while pulsations in the air delivery between gas blowing engines and hot blast stoves do exist, these pulsations disappear entirely beyond the stoves on account of the large volume of the latter. Tests made by Mr. West actually show that the difference between maximum and minimum blast pressure in the bustle pipe is insignificant, and that the pressure curve is practically a straight line. Uniform blast is only one of the items which have a bearing on the regularity of furnace operation and a comparatively small one at that.

If results of turbo blowers obtained in actual practice lead to the belief that at least 10 per cent. coke will be saved, and the output will be increased 10 per cent., I wish to point out that this may be entirely due to the fact that turbo blowers took the place of old reciprocating steam blowing engines. A similar observation was made at South Chicago when the old steam blowing engines were replaced by gas blowing engines a few years ago.

Mr. Rice calculates on the strength of his assumption of coke economy and increase pig iron production a saving of $416,000 per year for an eight blast furnace plant. Such a saving could only reduce the actual saving of gas engine installations mentioned in my paper, and it would still be necessary to burn coal to generate the necessary power in a steel plant of the magnitude of Gary.

That no constant care and overhauling are necessary on gas blowing engines, as Mr. Rice intimates, is proved by the fact that there are a number of gas blowing engines in this country and in Europe, whose operating record shows over 98 per cent. actual yearly running time of the total possible time.

Lack of space prevents me from giving in this discussion the details of a calculation which I made, assuming a blast furnace plant of two furnaces of 400 tons capacity each in the Pittsburgh district. In this calculation I find that from the available gas 14,500 kw. maximum can be generated when gas engines are installed against only 5500 kw. with turbo blowers and steam turbines. Assuming that power is generated at 65 per cent. use factor and sold to outside consumers, it will be found that with scavenged gas engines power can be produced 0.042 cent per kw.-hr. cheaper than with a steam turbine plant. In other words coal of 13,500 B.t.u. per pound would have to cost only 70 cents per gross ton to make a turbo blower and steam turbine plant economically equivalent to a gas engine installation.

The Modern By-Product Coke Oven*

Its Advantages, Quality of Product and Details of Construction of the Types Best Known in the United States

BY C. A. MEISSNER†

The great advantage which the by-product coke oven has over the bee-hive oven lies in a number of factors:

1. The by-product coke plant can be constructed at or near the blast furnaces which are to consume its coke, and thus be under the same management.

2. It is practicable to ship to it coking coals from any section within a radius of a favorable freight rate.

3. Many coals not suitable for coking in bee-hive ovens become available for by-product ovens by mixing with other coals and are so used to make a first-class blast furnace coke.

4. Coking coals in by-product ovens permit of the full recovery and use of the very valuable by-products and the gas.

5. The cost of making by-product coke at the iron and steel works is considerably less than the cost of making bee-hive coke at the coal mines and transporting the coke to blast furnaces, especially when located some distance away from the beehive districts.

6. The profits thus obtained give a substantial return on the investment in by-product coke plants, large though such investment may at first appear.

In fact, the by-product coke oven is changing the economic geography of the available coal fields for coking purposes in the United States. This is not the case with the beehive ovens, which in most cases are placed near the coal mine that supplies their coal, and when the mine is exhausted the beehive plant has to be abandoned. Many coals from large fields will not coke at all or only partially in beehive ovens, and the recovery of by-products from beehive ovens, while frequently attempted, has almost invariably proved to be an economic failure. It is true that in Germany a number of by-product coke oven plants are built at the collieries and ship the coke to blast furnace plants, but conditions are somewhat different over there and many of the large steel works are located at or near the collieries and thus are able to utilize more directly the surplus gas produced in the by-product oven.

Costs of Beehive and By-Product Coke Ovens

A great deal has been said about the comparative cost of by-product coke ovens versus beehive coke ovens. We have studied this very carefully and find that this is dependent entirely on the location of the beehive oven plant and the attendant conditions of such a location. Comparing, for instance, a by-product plant at Gary, Ind., with a beehive plant in the Pocahontas, W. Va., region, both on a large scale, and taking into consideration the mine investment, houses required for workmen and everything connected with the construction ready for operation of either type, we find that the beehive oven installation complete costs more than the by-product oven installation complete for the same number of tons coke produced per year. Comparing the above by-product plant with a similar beehive oven installation in the Connellsville regions, where all conditions are more favorable and where the difference in the yield of coke from coal coked in the beehive oven and in the by-product oven is very materially less than it is in the Pocahontas region, we find that the cost of a beehive oven installation complete is considerably less than the cost of a by-product coke oven installation complete, per ton coke produced per year.

A feature of supreme importance in the use of the by-product oven is the greater coke yield obtained in this type than in the beehive oven from the same coals. This amounts to about 23 per cent. to 25 per cent. in the low volatile coals, such as Pocahontas, and from 5 per cent. to 12 per cent. in the high volatile coals, dependent on their original content of volatile matter. This subject is not fully understood and generally appreciated and yet is of vast importance in the conservation of our coal fields. A concrete example will be of interest:

Pocahontas Coal	Bee-hive coke oven plant.	By-product coke oven plant.
Number of ovens	6,154	560
Coking time	72 hours	17½ hours
Yield of coke to coke	60 per cent.	82 per cent.
Net tons of coal required to produce 2,880,000 tons of coke per year	4,800,000	3,512,000
Net tons of coal saved per year by use of by-product coke ovens for above coke production	.....	1,288,000

This amount of coal saved, if it were coked in by-product ovens, would produce about 1,000,000 tons of coke per year. What this means in coal conservation, is so plain that no further comment is necessary.

Quality of By-Product Coke for Blast Furnaces

We have found in our practical experience that *when made right*, from many suitable coal mixtures, widely varying in volatile contents, by-product coke will give results in the blast furnace equal in every respect to the best of beehive coke. This, in my opinion, is unqualifiedly correct. It is further true that such by-product coke is preferable to beehive coke when the latter has been shipped from different coking operations and thus made from different coals, because the by-product coke when made from the same coal mixture is more uniform chemically and physically. I could point to some very unsatisfactory experiences where 15 or more different kinds of coal were shipped to the by-product coke ovens, the resultant coke being very irregular, both in analysis and physical quality. I emphasize ***when made right*** in referring to the quality of the by-product coke, for upon this depends its value.

The type of oven is not of such prime importance in this respect as the proper operation of the oven and the uniformity of its coal mixture. There are now five or six types of by-product ovens in operation, all of which are good. Some are more simple in construction and operation than others, but all are capable of making a good coke from similar coals if properly operated. That is the crux, and I want to call your particular attention to this.

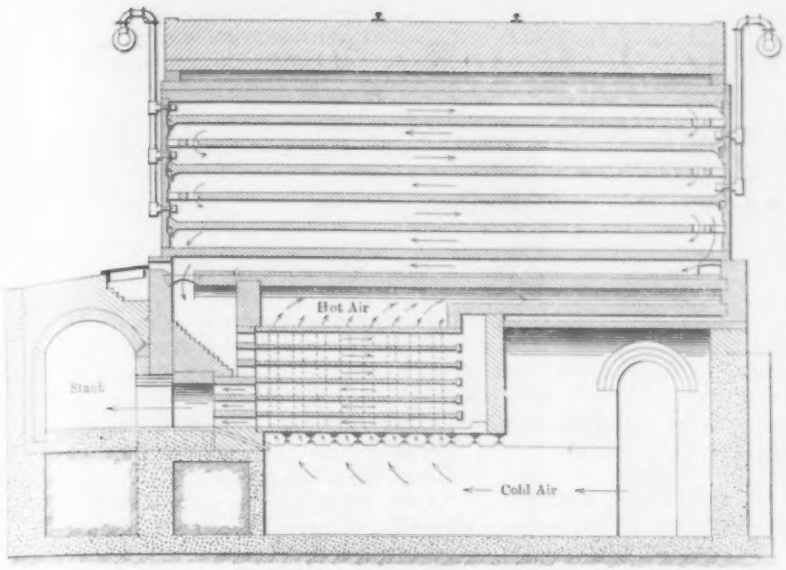
The by-product oven being a more delicate and complicated apparatus than the beehive oven naturally requires more care and attention. The coking time must be brought to the lowest practical point. This must be determined by experience. It must then be held there as closely as possible. The pushing must be regular; the temperatures of flues—and hence of ovens—must be held to conform to the coking time and be kept uniform. Over-coking is fatal to good coke, tending to make a friable and small coke. Further, the pressure exerted in pushing over-coked coke always tends to produce a larger percentage of small coke than when pushing a normally coked oven. Under-coking is bad, though, in my opinion, perhaps slightly less so than over-coking, tending to the production of lumpy coke, black soft ends and a softer cellular structure throughout. Increasing the coking time beyond what it should be, has always given us bad results when tried.

Our experience so far indicates that when it becomes necessary to curtail the production of coke, it is distinctly more profitable to suspend operations on one battery of a plant, keeping it heated with gas, and that the only time we are justified in prolonging the coking time is because of a temporary coal shortage likely to last but a short time. The experience at the Joliet ovens, where we have suspended operations on one battery a number of times, fully justifies the statement that it is preferable to do this than to prolong the coking time, which will then deteriorate all of the coke produced.

The uniformity of the coal mixture has a very im-

*Extracts from a paper read at the New York meeting of the American Iron and Steel Institute, May 23, 1913.

†Chairman Coke Committee, United States Steel Corporation.



Semet-Solvay By-Product Coke Oven

portant bearing on the quality of the coke. Each coal has its own individual characteristics in affecting the quality of the coke. In the case of some coals, this difference is slight and negligible; in the case of most coals, it is marked and distinctive and has probably not been as fully understood or realized as it should be and will be in the future.

A tabulation showing what we consider good physical tests for a standard quality of blast furnace coke may here be of interest:

Mixture	Shatter test: Through 2-in. screen	Shatter test: On 2-in. screen	Specific gravity: Apparent	Specific gravity: True	Porosity or percentage of cell space
80% Pocohontas .. 20% Ronco	15.16	84.84	.976	1.841	47.03
80% Pocohontas .. 20% Rend, 1 Ills...	16.11	83.89	.950	1.824	47.92
60% Pocohontas .. 40% Ronco	14.06	85.94	.992	1.834	46.31

Constructive Features of By-Product Ovens

BRICK

When the coke committee were discussing the construction of the Joliet ovens, they realized the importance of a shorter coking time than that of the German ovens, which then had a coking time of about 28 to 34 hours, and this brought up the question of the brick to be used. We required a strong brick that would stand the abrasion, the high temperature and permit of a rapid transmission of heat into the coal body from the flues through the oven walls. The brick very largely used in Germany was a quartzite. Experiments with silica brick had meanwhile been made by the Semet-Solvay Company and also by the Cambria Steel Company. After quite an exhaustive study of this subject, the coke committee recommended at Joliet, Ill., constructing No. 1 battery of silica brick, the raw material being obtained from the Baraboo District of Wisconsin; No. 2 battery of a St. Louis quartzite brick, the raw material being composed of Missouri clays, and Nos. 3 and 4 batteries of German quartzite brick obtained from Arloff, Germany. Following are the average analyses of these different kinds of brick:

Sample	Date	Loss on ignition	SiO^2	Fe^2O^3	Al_2O^3	CaO	MgO	K^2O
Silica	4-4-08	0.02	94.06	0.87	2.23	2.52	0.15	0.15
St. Louis quartzite	5-08	0.12	79.29	2.26	16.66	0.49	0.36	0.82
German quartzite	3-3-08	0.11	83.15	1.57	13.19	0.37	0.34	1.17

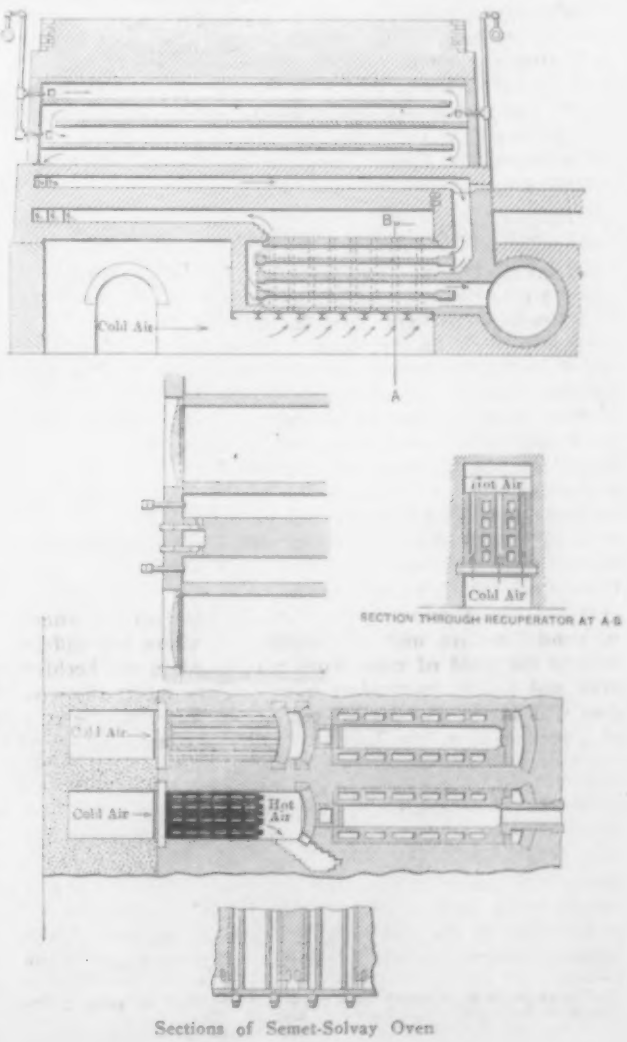
No. 1 battery, the oven walls and flues of which consist of silica brick, has always been the best battery in the matter of heat regulation and operation, owing to the ability of the silica brick to transmit the heat better than the quartzite brick. We believe the battery whose oven walls are constructed of silica brick will outlast the batteries whose oven walls are constructed of quartzite brick, both American and German. We have not yet had to reline any of the ovens constructed of silica brick, while we have spent a certain amount of money repairing the ovens constructed of the German and American quartzite brick. The indications also are that we use considerably less gas to get the same coking time with the silica brick than we do with the quartzite brick. We do not find much difference in the operation of the ovens constructed of American and German quartzite brick. After the construction of the Joliet plant, the consensus of opinion of the coke committee was that all future plants should be built with silica brick; that is, the oven and flue walls, due care being taken to arrange for the necessary expansion.

REGENERATORS

Regenerative ovens are more advantageous for installation at steel works, as a larger supply of surplus gas is available through regeneration than through recuperation, and this surplus gas is a very valuable asset to the steel plant. Whether to place the regenerators under each oven or longitudinally along the whole battery has been a subject of considerable discussion. I have seen many ovens of the latter type which have given uniform combustion temperatures; but, on the whole, I prefer the type having the regenerators under each oven, as I think it is easier to control the temperatures in such regenerators. Also, in a battery of ovens of this type, operations are not liable to be influenced by the action of any oven either not operating properly or shut down for repairs or other reasons.

FLUES

As to vertical or horizontal flue systems, both are in operation in this country. The horizontal flue system ovens are doing very good work and have, in my opinion, a merit of simplicity, and as far as I have been able to observe the combustion of gas and air in them has been controlled just as completely as in the vertical flue ovens,



Sections of Semet-Solvay Oven

so that just as uniform temperatures can be attained in either system.

The combustion in, as well as the accessibility to, the vertical flue ovens seems to me to be more easily and better controlled in those types whose flues open to the top of the oven than in those whose flues are only accessible from below or entirely closed in, and the great objection to many of these latter types is that if anything goes wrong at any time with any flue, it is almost impossible to remedy this without stopping the oven and tearing out some of the brick work, while this is not necessary in types that open to the top of the oven, or in the horizontal type. It is just in this respect that many of the newer and some of the older types of ovens fail to appeal to me, because their system of combustion and carrying off to waste gases is too complicated and too inaccessible.

It is some times claimed for these types that they will give a more perfect combustion by this method; in fact, the laudable effort on the part of the engineers studying this problem is toward perfection of combustion. On the other hand, from a practical view point, I fail to see why there should not be obtainable in the standard vertical flue types or in the horizontal type of oven a very perfect combustion and temperature regulation of flues and oven walls. I do not see the necessity for extreme refinement and complication when the simpler form can, to my mind, be made to accomplish what is required.

A feature to be studied and watched very carefully is the construction of the flue walls in such a manner that leakage, or short-circuiting of air and products of combustion from one flue to the other cannot take place. This is usually caused at the very beginning when the oven is heated up and expands, and any flue system that is complicated and has more than the absolutely necessary passages upward or alongside the oven walls, subjects itself to danger from this source. It is for this reason that it is always a dangerous experiment to construct any large number of ovens without having first experimented in a practical way with a certain type on a fairly large scale, or to construct an oven from paper, that is, from drawings without previous practical experimentation and covering a sufficient period of time.

AIR PORTS AND DRAUGHT

A very important matter to be kept in mind is the area of the air ports and flues in which the combustion takes place, as upon it will largely depend the coking time. For a short coking time, plenty of area is required to enable the operator to burn sufficient gas to give him the temperatures he desires. The earlier construction rather erred in this, with the result that frequently there is not quite sufficient draught to give the necessary rapid combustion for high heat. While this can be corrected through increased stack draught or induced draught, yet for new construction it is a problem worthy of very careful study. In my opinion, there should be one draught stack to every battery of coke ovens with sufficiently large flue area to take care of atmospheric or other fluctuations.

TAPER OF COKE OVENS

It has been found that a taper of about 4 in. in the width of the oven from the pushing end to the discharging end is of great importance, especially where swelling coals are used, but even where this is not the case, a taper is always of advantage, as thereby less resistance is offered by the walls of the oven to the movement of the coke. After the first effort of putting the coke mass into motion the pushing is made easier, less small coke is produced and the walls of the oven are conserved. Practically all the different coke oven systems now have arranged their heating flues in such a manner that the necessary amount of heat penetrates into the coal mass at the wide end of the oven in the same time as it does in the narrow end.

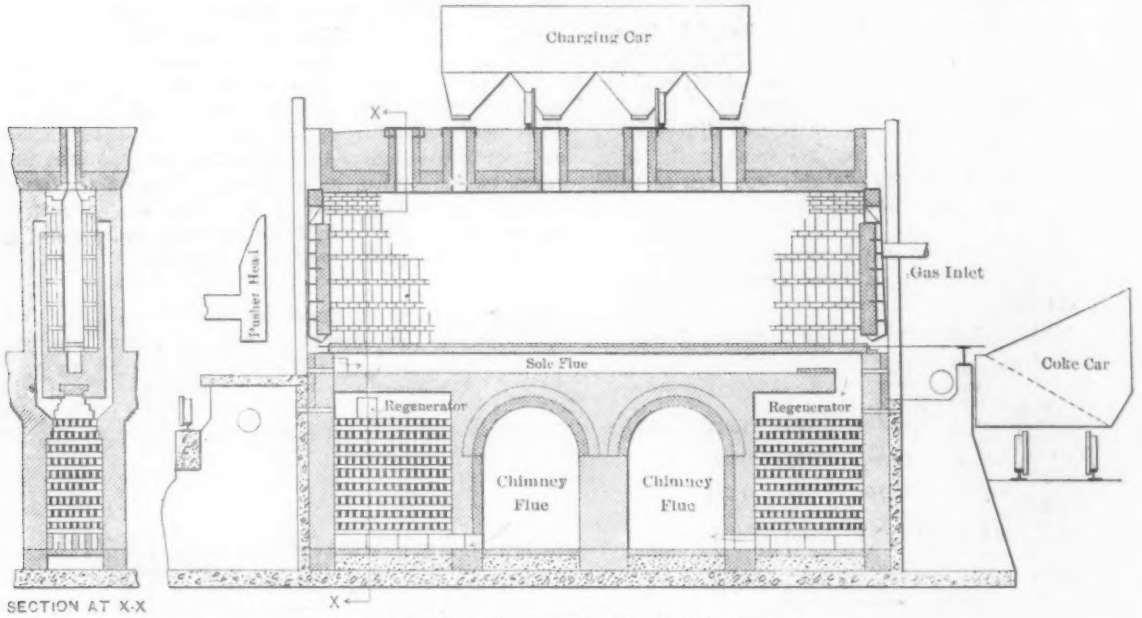
WIDTH OF OVEN AND COKING TIME

The question of the width of oven is a very important one, and, to my mind, it has by no means been determined that the width of oven now generally adopted—namely, an average of about 19 in.—is the limit to which we can go and produce satisfactory coke within a reasonable coking time. In modern systems, the heating arrangement is so flexible that with a wider oven sufficient increased heating can be applied to attain a similar coking time to that in the narrower oven. As a matter of fact, we built our early ovens for a 24-hour coking time after considerable discussion on this very subject of width of oven in connection with coking time. On the same width of oven we reduced this coking time down to 16.5 or 17 hours. At the Birmingham, Ala., ovens the taper was decreased, causing an average increase in width of ¾ in. more than in the Gary, Ind., ovens. This was for a high volatile coal mixture compared with the Gary, Ind., mixture, and yet the coking time at Birmingham is down to 17.2 hours and will undoubtedly be still further reduced. The coke ovens at Farrell, Pa., with a width of 17 in. and no taper, have a coking time of 20 hours. The Riverside coke ovens, with a 17-in. width, are running on a 20-hour coking time.

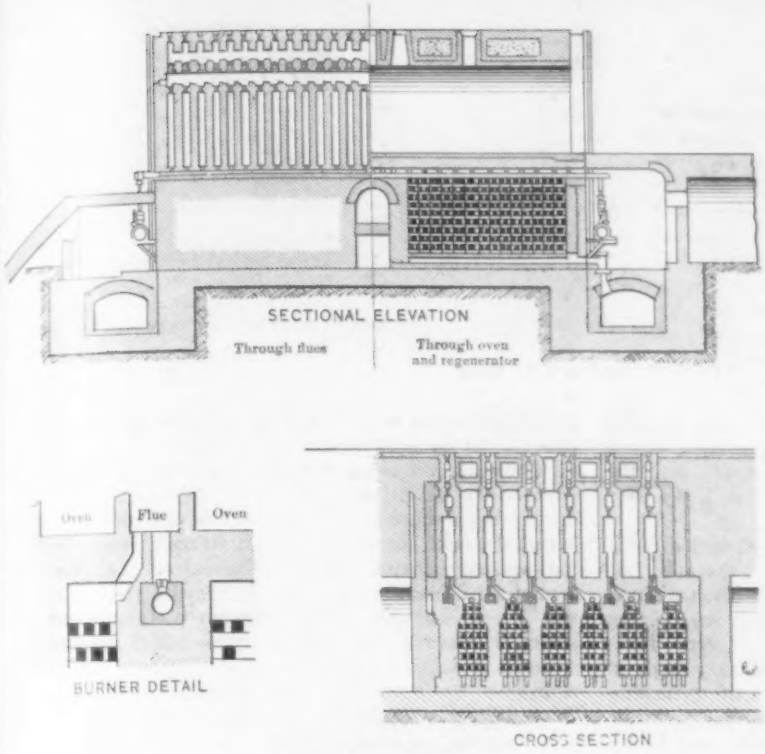
The same applies to the use of high volatile coal. It has been claimed that with high volatile coal the coking time would be materially increased; in fact, that the coking time increased in proportion to the width of oven and the higher volatile matter contained in the coal mixture.

I think we are demonstrating to-day that, with mixtures of 20 per cent., 40 per cent., 60 per cent., 80 per cent. and 100 per cent. of more or less high volatile coals, we are having practically the same coking time, providing the conditions of heating the oven are sufficiently taken care of to accomplish this.

We have changed our coal mixture at the Joliet and Gary, Ind., plants from 20 per cent. to 40 per cent. high



Semet-Solvay Regenerative Retort Coke Oven



Koppers By-Product Coke Oven

volatile coal without any practical change in the coking time. There is no question that we will reach a limit when, with the best of heating arrangements and burning of ample gas, we will arrive at a point where the coking time will become directly proportionate to the width of the ovens. The same may become true of the larger admixture of high volatile coals.

This whole subject of increased width, hight and length is of great importance in determining the ultimate capacity of by-product coke ovens so far as the daily output of a given plant is concerned, as the greater this output is the more economical the operation would become, though great care has to be exercised not to exceed whatever may be the ultimate limit of size. At present we do not know what these are; I do not think, though, that we should stand still in our efforts to determine same.

COKE OVEN DOORS

Another problem that we have all been working on for some time is coke oven doors. The by-product oven ought to have a self-sealing door. The present system of clay-luting the doors is expensive as far as labor and material is concerned; it takes considerable time and, if not done properly, causes leakages through variations in pressure which burn up part of the coke and deteriorate the by-product and the gas. A self-sealing door that is simple, strong, easily adjusted and taken care of and not subject to warping is a prime necessity. Quite a few attempts have been made in this direction—some of them fairly successful—but we do not consider that any of them are quite satisfactory as yet.

Coke Quenching and Screening

One of the serious problems that confronts by-product coke oven operators is the proper method of quenching and screening the coke, especially on a large scale, when but six minutes are allowed between the time of pushing one oven and the next oven to be served by the same screening station, as in a large plant like Gary, Ind.

At Joliet we have the quenching bench directly in front of the oven. A certain amount of water is sprayed over the coke as it is being pushed out of the oven and the mass of coke then, after steaming, is watched to note any appearance of red hot coke, which can be quickly quenched by hand with a small hose. This method of quenching permits of three or four charges lying in front of the battery, gives time enough to quench without soaking the coke and insures a very reasonable and low uniformity in moisture. An objection to this system is the heavy mass of steam formed directly in front of the oven while the coke is being quenched and is steaming off.

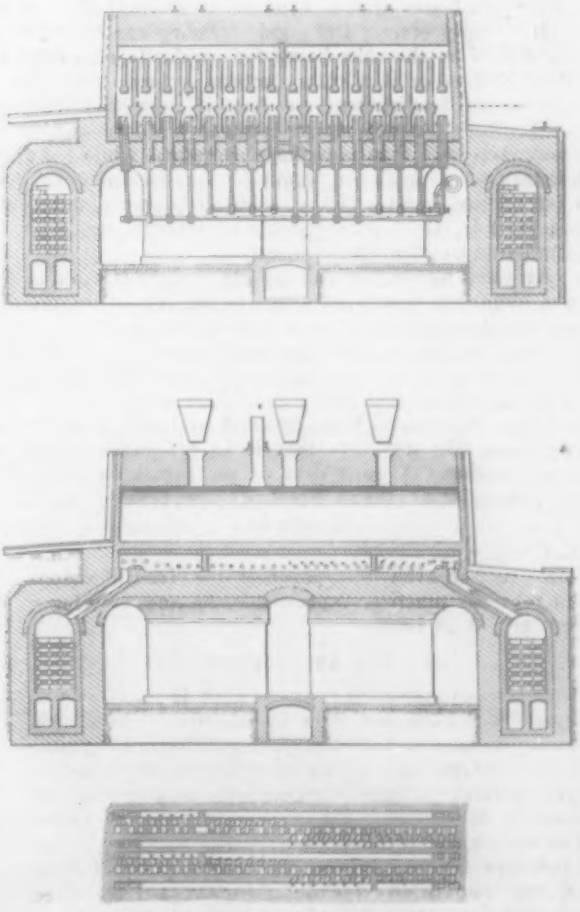
At most of the other plants in the country, various types of quenching cars are used, into which the coke is pushed and then conveyed by motor or locomotive to a quenching station, where water is sprayed over it. After that, different plants handle this coke in different ways. At some plants the quenching is still done in front of the oven in the car. This is very objectionable. Most plants have a separate quenching station away from the ovens; in some the coke is held on these quenching cars long enough to steam off and any small pieces of red-hot coke are quenched by hand with a small hose. At other plants, the coke is partly quenched in the car and run on inclined platforms or pockets, where it is again hand-quenched before sliding it into elevators or belts, which convey it to the screening station.

To hold coke on quenching cars is expensive as it means an extra supply of these rather costly cars and is hardly practicable for a large plant. The system installed at Joliet has worked out very well on the whole; but the system adopted at Farrell, of pockets with inclined sides from which the coke is dropped on a belt, seems to me to be very efficient and very simple. As these pockets can be made long enough and their inclined sides wide enough to hold a number of charges of coke, it gives the coke sufficient time to be properly quenched and steamed off.

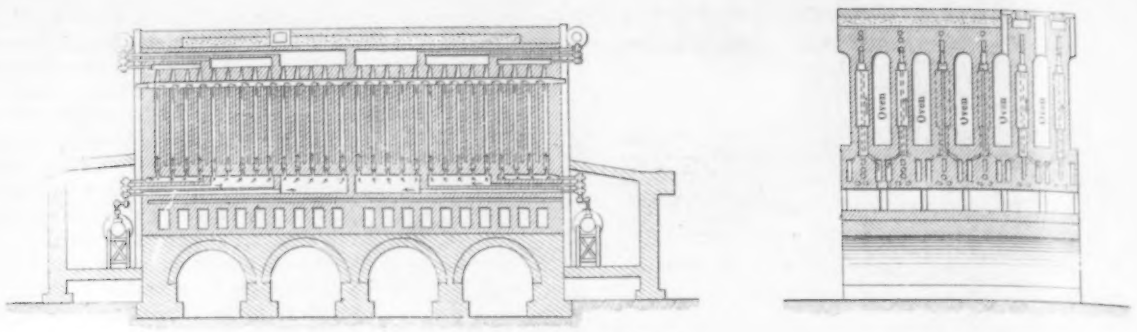
A NEW METHOD AT DULUTH

At Duluth a different system will be tried out—having the quenching platform away from the end of the ovens, so that the coke can be quenched preliminary in the car, then dropped on this platform away from the ovens and the quenching process finished there.

At one plant, the coke is partly quenched on the car,



Otto By-Product Coke Oven. 1 and 2, One Burner for Each Two Vertical Flues. 3, Section Through Gas and Air Flues



Collin By-Product Coke Oven

then raised to a wide inclined screen upon which it rests sufficiently long to steam off and be hand-quenched with a small hose before it is dropped over the screen into the railroad car. This is as yet experimental, but looks very promising.

Where the coke has to be completely quenched directly on the car and the car supply is inadequate, the coke has to be practically drowned or saturated with moisture. This not only fills the pores of the coke, but in my opinion also tends to crack into small pieces and is very detrimental. The resultant coke will always be very high in moisture. Methods in operation in Europe of quenching the coke in ladles or pans by practically steaming it, while undoubtedly capable of producing good results, are in my opinion hardly applicable to operating conditions in this country, unless materially modified.

The coke after being quenched is raised to the screens, either by means of large hoists or belt-conveyors. We have had some very good results by using a belt conveyor. If proper precautions are taken in the quenching of the coke, a belt will last a long time. The belt method of elevation permits of a more even distribution of the coke on the screen than when the whole mass is precipitated out of the large bucket. Of course, a plant has to be laid out for this purpose.

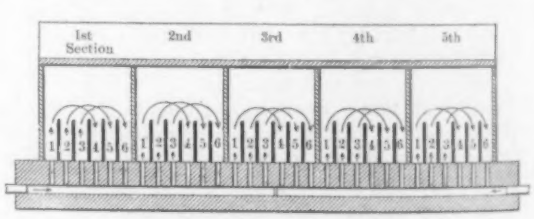
PROVISION FOR SCREENING.

The proper screening of the coke I consider an absolute necessity, whether this be done on an inclined plate screen or in a rotary screen, and good screening can only be accomplished by the coke being fed gradually on to the inclined screen, or if a rotary screen is used, having same long enough to distribute the mass of coke as it falls into it. Too long a rotary screen is apt to grind the coke at its lower end more than is perhaps necessary, while too short a rotary screen will not permit of the mass of coke, even when coming from a belt, to separate properly, unless the belt feed is made slow enough to prevent any large accumulation of coke on the screen.

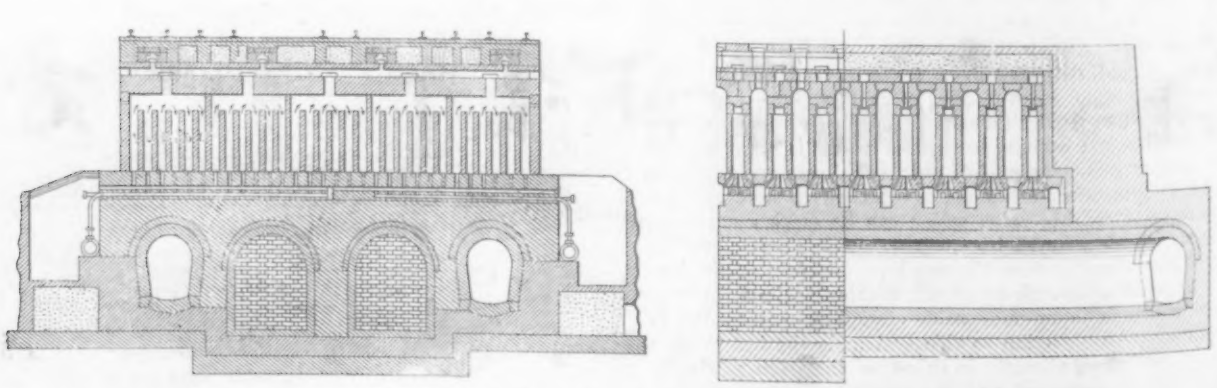
At some plants, the coke is not screened at all at the coke plant, but is carried direct to the blast furnace coke bins and screened as it drops out of the bins. As a rule, this has not been satisfactory because the mass of coke in the bins is too large and the passage over the screens too swift to permit the fine particles to drop through the screens. It may be that sufficient screening can be arranged in this way, but that is to my mind subject to demonstration. A good deal of the success in screening also depends on the dryness of the coke as the fine particles of dust will cling to a wet coke very persistently and cannot be shaken off.

There is still some difference of opinion among blast furnacemen as to the detrimental effect of coke breeze. To my mind there is no question that the more free from breeze the coke goes into the blast furnace, especially under out present furnace operating conditions with high percentages of Mesaba ores, the better the results obtained will be. At one plant an experiment was made using unscreened coke in the blast furnaces, which resulted in a material increase in the blast pressure, while the furnaces refused to drive and the coke consumption was increased. Of course, in considering the thoroughness of screening, it is necessary to consider also what can be done with the coke breeze and coke dust, where it can be utilized and what its market value will be. At most of our plants, the coke dust is used in making bottoms in soaking pits and other similar places, and in some districts the coke breeze commands a fair market as domestic coke. The experience that we have had with a special grate system has been very satisfactory for the burning of coke dust up to ¼ in. in size.

The screened coke, varying with the handling it receives, is apt to be somewhat irregular in size and experiments are now being made to determine whether it would be advisable to crush the oversized coke, say over 4 in., to practically 4-in. coke and less, and thus obtain better results in the blast furnace. There is a large variance of opinion on this subject. Many of the furnacemen, accustomed to the use of beehive coke in rather large pieces, find it hard to accommodate themselves to the idea that furnace coke should be small, but the physical structure of beehive coke and by-product coke is so different that the experience of those who have so far studied this matter closely, inclines one very strongly to the advisability of a uniform, fairly small coke with our present furnace burden mixture. By-product coke is denser in cellular structure than the average beehive coke, and, burning more slowly, the exposure of a large number of surfaces ac-



Arrangement of Flues in Coppée Oven



Coppée By-Product Coke Oven

celerates combustion in the hearth. Besides, it seems that with the large amount of fine ore now used a more even distribution of the fuel in the burden, as it descends in the blast furnace, must be of advantage. If it is finally determined that a smaller and more uniform size of coke is advisable, it is not a difficult matter to arrange for the oversize coke to be screened out in the first screening, crushed and rescreened before delivery to the blast furnace bins.

The Various Types of By-Product Coke Ovens

Referring to the many types of retort coke ovens that are in the market, I will add some illustrations of these coke oven systems that are of particular interest at this time, together with a short description of each system.

Semet-Solvay Recuperative Retort Coke Oven

This oven until very recently has been entirely non-regenerative but recuperative, and heating is performed in horizontal flues instead of in vertical flues. The most modern plant in this country is of the six-flue type, which is the result of gradual evolution from the original three-flue oven. Gas for combustion is supplied to each horizontal flue from a burner pipe entering at the end of the flue. The air for combustion of the gas is drawn by stack draught through the recuperators into risers at the ends of the oven, whence it passes through an opening at the end of the flue, into the horizontal heating flues, the amount of air being regulated by a sliding brick for each flue.

Combustion starts in the top flue and the products of combustion traverse each horizontal flue, the necessary amount of heat to maintain a uniform temperature being obtained by the admission of fresh air and gas into each horizontal flue as required, by the method above described. In order to allow for the greater volume of products of combustion, the flues gradually increase in size until the bottom flue is reached; this is reduced in size, as only a portion of the products of combustion pass through the bottom flue.

The products of combustion pass out into the recuperators, partly from the bottom flue and partly from a sole flue located beneath the oven, the amount to pass through each of these being regulated by a sliding brick.

A feature which adds to the strength of the Semet-Solvay oven is an 18-in. division wall between the ovens. This allows the operation of an adjoining oven, while an oven is being repaired. The earlier type of Semet-Solvay ovens had no taper, while in the latter types sufficient taper to meet the requirements of the coal used is employed. This taper is accomplished by tapering the central division wall.

Semet-Solvay Regenerative Retort Coke Oven

One of the more recent developments of the Semet-Solvay type is the regenerative oven. The design has been worked out so that the construction is very simple. A pair of regenerators are located beneath each oven, with the chimney flues between them. The reversal of the gases takes place throughout the entire system of regenerators and horizontal flues, so that during one period of reversal the gases flow upward through the flues, and during the other period downward. The gas is supplied continuously, and is reversed automatically by the gas currents without any attention by the operator.

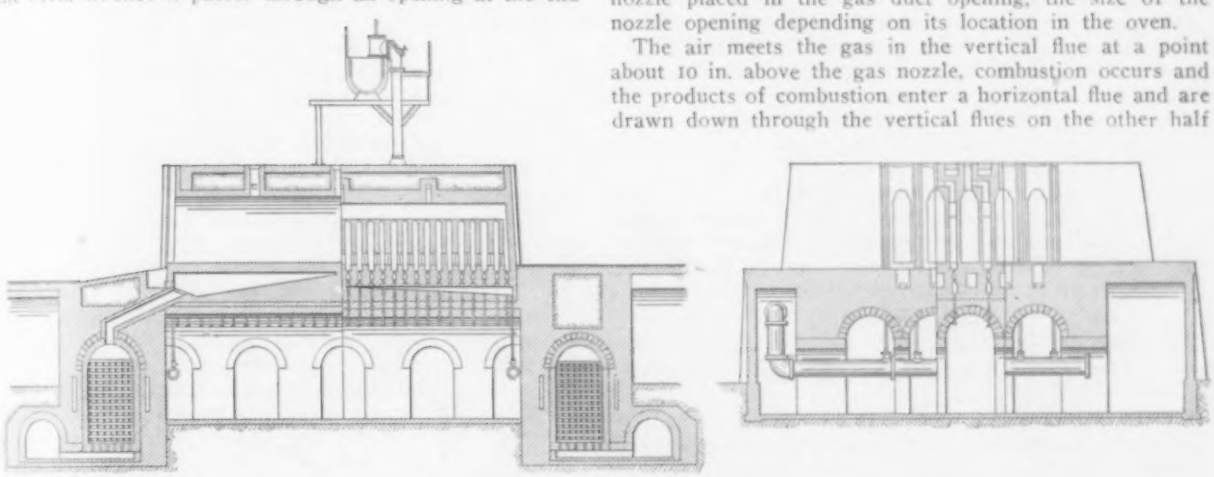
As compared with the older recuperative oven of the Solvay type, the regenerative oven is especially adapted to coking conditions requiring the highest temperatures and to installations where the maximum amount of surplus gas is desired and the utilization of the waste heat for steam raising is of comparatively minor importance. Even in this type of oven it may sometimes be economical to introduce waste heat boilers between the regenerators and the chimney because the air has capacity for taking up only a portion of the heat delivered by the products of combustion. The selection of the recuperative or the regenerative type of oven has in each case to be determined by the commercial and operative conditions existing at the plant in question.

Koppers Retort Coke Oven

In this type, heating is performed on each half of the oven alternately, reversal being made each half hour. One system of heating is followed in the Koppers type, as follows: Air for combustion is delivered from the regenerators into each vertical flue through individual openings in the roof of the regenerator chamber.

Gas for combustion is introduced from the gas main into a fire-brick gas duct, located below the vertical flues, and provided with an individual opening to each vertical flue. The gas enters the vertical flue through a fire-clay nozzle placed in the gas duct opening, the size of the nozzle opening depending on its location in the oven.

The air meets the gas in the vertical flue at a point about 10 in. above the gas nozzle, combustion occurs and the products of combustion enter a horizontal flue and are drawn down through the vertical flues on the other half of the oven into the regenerators and thence to the stack.



Still Regenerative By-Product Coke Oven

Individual regulation of the draught is accomplished by means of a sliding brick in each vertical flue, which controls the size of the opening into the horizontal flue. This is to overcome the tendency of the gases to take the shortest route to the chimney, which would result in the center flues taking away the bulk of the hot gases and, therefore, causing unequal heat. Access to this sliding brick is afforded by an opening to each vertical flue from the top of the oven, this opening normally being closed by a plug. This inspection hole also allows access to the nozzle in case it is desired to change same.

Regulation by means of a sliding valve is provided for the air supply for each individual oven, and the sliding brick before referred to provides individual regulation of the air supply to each vertical flue during the period of combustion. Regenerators in the later Koppers installations are individual for each oven.

Retort Coke Ovens of the Otto System

In two of the four types of Otto ovens described below, heating is performed on each half of the oven alternately; the products of combustion pass down the vertical flues of the other half of the oven. In the other two types of Otto ovens the oven is divided into four sections. The products of combustion formed in simultaneously heating, for instance, the first and third sections pass down the vertical flues of the second and fourth section respectively. In each case reversal is made each half hour.

The air for combustion is delivered from the regenerators into an air chamber running beneath the sole of the oven. From here the air passes through openings in the wall into a combustion chamber which is located below the vertical flues. Here the air meets the gas introduced from the main and combustion takes place. The burning gases travel through the vertical flues, where

combustion is completed, and the products of combustion travel down the other vertical flues, through the air chamber into the regenerators and thence to the stack.

Regulation of the amount of air and draught is accomplished by an accessible sliding brick by means of which the size of the opening from the regenerator to the air chamber can be controlled.

In attempting to arrive at uniform heating conditions, several methods have been devised by the Otto people of delivering the gas into the combustion chamber in such a manner as to produce economical and uniform combustion. There are three different methods now being followed in Europe, and experiments are being carried on to determine which is the best. In America, another method is followed. These four systems of heating are as follows:

1. *Three tier gas burner plan.* In this system, the gas is introduced from the main into the combustion chamber by three gas pipes, located in a tier at each end of the combustion chamber. There are usually 32 vertical flues per oven, 16 in each half. One burner supplies gas for the first four of these vertical flues, the second supplies gas for the second six, and the third burner supplies gas for the rest of the vertical flues in this half of the oven. The combustion chamber is arranged in three sections, each communicating with its own burner.

2. *One gas burner for each two vertical flues.* In this method the gas is introduced into the combustion chamber in a 32 flue oven, from 16 burner pipes entering the combustion chamber from below the ovens. In this way, one gas entry is provided for each two flues.

The heating operation is conducted as follows: Supposing the gas burners are numbered from 1 to 16. During one-half hour, gas enters the combsution chamber from burners 1 to 4 and 9 to 12, and the products of combustion travel through the vertical flues supplied from burners 5 to 8 and 13 to 16 respectively. The next half hour this process is reversed, and so on.

In this method the travel of the off-heat gases appears to be under bettter control than in the former method of heating, on account of not having to travel so far. In other words, the off-heat is withdrawn from each quarter of the oven instead of from each half.

3. *One gas burner for each vertical flue.* This is the latest method and has not been exhaustively tried out as yet. Theoretically the results ought to be better than the other methods described. The products of combustion are withdrawn similarly to the scheme described under head of "One gas burner for each two vertical flues."

4. *American system of end-burner and under-burners.* After using various methods of heating, none of them, so far as known, following any exact German methods but always comprising some modification, the American representatives of the Otto type of ovens have practically settled on a system of heating, employing one end-burner and two auxiliary or under-burners for each half of the oven. That is, the gas enters the combustion chamber through a burner located at the end of the oven wall, and any further gas supply which may, in the judgment of the heater, be required, is furnished by the two under-burners, which deliver gas into the combustion chamber from the alley ways below.

An essential point of difference in the American system is the fact that only one downtake for products of combustion to the regenerators for each three ovens is provided, and vice versa one air intake. In Germany, special stress is laid on the necessity of having an individual downtake for each oven. The Otto system of regenerators are of the long type, two being provided, running the entire length of the battery. One of the illustrations shows the heating system using one gas burner for each two vertical flues. This method probably gives the best results.

Collin Retort Coke Oven

In the latest type of Collin oven no reversal from one-half of the oven to the other half occurs, gas for combustion being alternately introduced from the bottom and from the top of the vertical flues, instead of from alternate halves of the oven. During the first half-hour period the gas for combustion comes in contact with the regenerated air for combustion on entering the bottom of each main vertical flue (of which there are 28 per oven). After burning upwards, the products of combustion descend through a second set of 28 flues immediately adjoining and enter into a sole flue.

During the second half-hour period, the gas for combustion enters the top of each of the 28 main vertical flues and comes in contact with the regenerated air, which issues from the top of the 28 smaller flues, through which the products of combustion flowed during the first half-hour period. Combustion occurs downward through the main vertical flues, the products passing into the sole flue.

The products of combustion pass from the sole flue into a series of rectangular brick passages located beneath the entire battery of ovens, and running at right angles to the oven chambers. This series is divided into two sections, one of which receives the products of combustion for each half-hour's heating. These two sets of fire brick passages lead into two regenerators located between the ovens and the draught stack. The gas for combustion is introduced by the tier system of end burners, there being four for each end at the bottom of the oven, in the latest system, and two for each end at the top of the oven. One of the four bottom burners is reserved for the end or outside flue alone, and the others each supply the gas requirements of four to five vertical flues.

Copper Retort Coke Oven

In the latest type of Coppée regenerative ovens, the side wall is composed of 30 vertical flues, divided into five groups of six flues, each group forming one combustion chamber.

Under each side wall of the oven are four gas distributing flues, two at the front end of the oven and two at the back, and gas for combustion is supplied through these alternately each half hour; that is, one at the front and one at the back are on gas one-half hour, and the other one at the front and back are on gas the next half hour, and so on.

Supposing the vertical flues are numbered from 1 to 30, the first group would comprise flues 1 to 6. During one-half hour gas for combustion would be delivered from one front duct to flues 1 to 3, combustion would there occur and the products of combustion pass through flues 4, 5 and 6. Simultaneously gas would be delivered to flues 7, 8 and 9; 13, 14 and 15; 19, 20 and 21, etc.

During the next half hour, gas would be delivered from the other front duct to flues 4, 5 and 6, and the products of combustion pass through flues 1, 2 and 3. Simultaneously gas would be delivered to flues 10, 11 and 12; 16, 17 and 18, etc. Products of combustion pass into a sole flue, thence into a collecting main running the length of the battery, and thence into the regenerators en route to the draught stack

There are two regenerators running the entire length of battery, and while one is preheating the air for combustion in one period, the other is being heated by the products of combustion. The regenerated air for combustion traverses the system in the opposite direction to the travel of the products of combustion, finally passing from the sole flue through oblique openings into the base of the vertical flues where it comes in contact with the gas and combustion occurs.

Still Retort Coke Oven

This is a vertical flue oven and is built in two types, viz., off-heat type, with no by-product recovery, and regenerative type with by-product recovery. The regenerators are common to all the ovens in a battery and extend the length of the battery on each side. The vertical flues are not accessible from the top.

The gas for heating passes from the main into a gas duct beneath the oven, and this gas duct tapers from each end of the oven to the center. The gas passes from this duct through a double nozzle into the vertical flues. The diameter of the opening in the upper gas nozzle is about half the diameter of the opening in the lower nozzle, and there is a vertical space of about 4 in. between the nozzles. It would be impossible to change a nozzle without tearing out part of the oven wall, but it is stated that it is not necessary to change a nozzle for any cause.

The air for combustion passes from a duct underneath the oven tapering similarly to the gas duct, through ports into the vertical flue; it is delivered into the vertical flue at two points, one located at about the level of the gas entry, and the other, by means of a slotted brick, at a point about 15 in. above the other entry. The idea of this is to prevent complete combustion low down in the flue, thus preventing an excessive heat at the bottom of the oven.

The Machinery Market

The greater part of the demand throughout the country continues to be for single units and in general there has been but little change in conditions. In some localities labor is a problem because of scarcity and strikes. Two or three centers report a betterment in activity. The New York trade, which has found the railroads slow in buying announced requirements, is giving most of its attention to navy yard requirements, and admits that new business has slackened. In Philadelphia the better demand has been for power equipment, other lines having fallen off. In Cleveland trade generally has been quiet, with sales confined to single tools, although some good business has been done in handling equipment; common labor is scarce and commanding unusually high wages. Trading is scattered in Cincinnati and the export business is slow. The Detroit market is displaying more life, machine tools have a better call and power equipment is in good demand, but labor troubles are a drawback. The labor situation has improved in Milwaukee; the single tool demand is maintained and the automobile trade is entering the market. A conservative trend is still evident in St. Louis and orders are for small lots and single machines. In the central South the export demand is somewhat stronger and trade, though irregular, is considered satisfactory. In the Birmingham territory and in Texas conditions are unchanged and dealers express satisfaction.

New York

NEW YORK, May 28, 1913.

The local market has changed to a very slight degree since the last report. The trade still is giving a good part of its attention to the navy yard requirements of the government. The large list of equipment to be purchased by the Navy Department, Washington, for the new yard at Pearl Harbor, Hawaii, has been augmented by several additional requests for estimates to be submitted by June 10. The Government also has asked for bids on a number of tools for Eastern navy yards. These include a 36-in. boring and turning mill for the Brooklyn yard on which bids are to be in by June 3 and the following machines on which bids are wanted before June 10:

Two air compressors, f.o.b. works.
Two 2½ x 26-in. turntable lathes for Portsmouth, N. H.
One hollow hexagon turret lathe for Norfolk, Va.
One 3 x 36-in. flat turret lathe for Norfolk, Va.
One 2¼ x 24-in. flat turret lathe for Norfolk, Va.
One hydraulic joggling press for Brooklyn, N. Y.
One hydraulic shear for Brooklyn, N. Y.

While some of the manufacturers' salesmen say they find business extremely slow, some of the dealers report scattered, miscellaneous sales which are considered fair in volume in view of the approach of summer, labor troubles in western New York and other influences which have caused the slowing up in new business which now is admitted generally. It has been noticed in several directions that many of the smaller buyers are asking for extra extensions of time for payments, some of them asking for ninety days. In a few of these instances sales have been made only in consideration of a liberal period for settlement. Otherwise collections are pronounced to be fairly satisfactory. The Pennsylvania Railroad has placed some orders against its large list of inquiries, but the three or four other roads which have made known their needs have withheld orders so far. The New York Central asked the trade for estimates on a few machine tools this week.

The Abendroth Bros., Port Chester, N. Y., manufacturer of gas and coal ranges, furnaces, heaters, soil pipe, etc., are building a new pipe-cleaning mill and are also installing a traveling crane with electric magnet for unloading pig iron and scrap.

The Oswego Falls Pulp & Paper Company, Fulton, N. Y., will build a two-story factory and office building, 30 x 100 ft., to cost $20,000. H. L. Paddock, Fulton, is president of the company.

The Clark Textile Company, Saratoga Springs, N. Y., is taking bids for an additional mill, 32 x 172 ft., fireproof construction.

The village of White Plains, N. Y., is to build an incinerator plant for garbage destruction to cost about $30,000, from plans of Engineer Joseph B. Rider, South Norwalk, Conn.

The Afton-Windsor Light, Heat & Power Company, Center Village, N. Y., will construct a hydro-electric power plant with a steam auxiliary plant, also two substations—one at Afton and one at Windsor. Contracts will soon be let. C. F. Wright, Susquehanna, Pa., is president of the company.

The Interior Metal Mfg. Company, Jamestown, N. Y., manufacturer of metal furniture and interior finish, has been reorganized with $80,000 of new capital. Frederick E. Hatch is president, Charles A. Anderson vice-president and O. M. Otte secretary-treasurer.

The Kingston Factory Corporation, Kingston, N. Y., will build a factory 50 x 130 ft., two stories and basement. The company has plans in progress for additional factory buildings to be erected for leasing.

The Ulster County Cleaning & Dyeing Company, Kingston, N. Y., will soon let contracts for a one-story factory, 35 x 81 ft., with an ell 28 x 53 ft., at Wall and Johns streets.

The Syracuse Suburban Gas Company, Syracuse, N. Y., recently organized, has secured authorization from the Public Service Commission for the construction of a gas plant and the laying of the necessary mains.

The R. E. Dietz Company, 221 Wilkinson street, Syracuse, will build a four-story factory, 56 x 120 ft., plans for which have been completed. Work will soon be begun.

The Dobbie Foundry & Machine Company, Niagara Falls, N. Y., contemplates building a new gray iron foundry, 100 x 200 ft. This will increase its molding capacity from 12 to 32 tons. The building will be equipped with two 15-ton electric cranes, several molding machines, core ovens, etc.

The International Acheson Graphite Company, Niagara Falls, N. Y., has let contract for a 40 x 80-ft. two-story addition to its plant at Buffalo avenue, Portage Road and the Niagara Junction Railroad.

The Stanley Construction Company, Buffalo, has been incorporated to manufacture iron, copper and tin specialties. E. C. Schlenker, L. S. Bentley and E. L. Marshall, Buffalo, are the incorporators.

The Lahodney Machine Company, Buffalo, N. Y., has filed certificate of incorporation with a capital stock of $25,000, and will equip a factory for the manufacture of beer-cooling machinery and apparatus. William Lahodney, James McGillick, Charles A. Hine and Michael Murphy are the directors.

Bids are being taken by the U. S. Hame Company, Buffalo, for a blacksmith shop 40 x 225 and a storehouse 37 x 180 ft., one story, to be added to its plant at Tonawanda street.

Philadelphia

PHILADELPHIA, PA., May 27, 1913.

Reports from manufacturers and merchants vary materially as to the volume of business moving. A fair run of orders has been closed by some, while others report almost an entire absence of new business. New inquiries are generally reported to have been materially lighter, particularly in connection with machinery and tools. In power equipment, however, a very fair demand for boilers and engines of moderate capacity is coming out. Machinery and tool builders are fairly busy, but not in all cases does new business equal in volume that being completed and shipped. Railroad buying is light. The second hand machinery trade is dull, reflectng conditions in general lines. Foundry activity is a trifle less pronounced, although both gray iron and steel casting are fairly well engaged but are taking on less business for extended delivery.

It is reported that efforts will be made to reorganize the New York Central Iron Works, Hagerstown, Md., which was recently placed in the hands of receivers.

It is proposed to refinance the company by placing a mortgage on the Hagerstown plant and selling the old plant at Geneva, N. Y. Plans involve a bond issue of $100,000.

The contract for the electrical equipment for the Adelphia Hotel, now building at Chestnut and Thirteenth streets, has been awarded the United Electric Construction Company, which will install two 200-kw. and one 100-kw. generators, direct connected, with Erie Ball engines. Separate awards will be made of the boilers, pumps and power equipment and other mechanical equipment.

The Reading Iron Company, Reading, Pa., is making improvements to is sheet mill at the foot of Spruce street. A small electric crane has been purchased and will be installed to facilitate the loading of muck bar.

It is stated that the National Chewing Gum Company has purchased a plot of ground on Haddon avenue, Camden, N. J., where a factory for manufacturing chewing gum will be erected.

The R. W. Jefferis Company, Camden, N. J., is taking bids for the construction of a two story factory building 73 x 93 ft. at Eleventh and Linden streets. The building is to be of brick and concrete with steel sash. Elevators are to be installed and at a later date the matter of power equipment will be considered. The company manufactures steel lockers and may purchase additional machinery before the completion of the building.

Markowitz Bros. have awarded a contract to Irwin & Leighton for the construction of a six story manufacturing building at 321-323 Market street. The structure is to be of reinforced concrete and will extend to Tilbert street. At a later date the purchase of a boiler and engine for power purposes will be considered.

H. B. Underwood & Co., operating the L. B. Flanders Machine Works, will not, as recently stated in these columns, incorporate the business. Plans had been practically completed and the intention of the incorporation advertised, but it was decided to discontinue proceedings and to continue the business as an individual partnership, the partners being Morris G. Condon, David C. Hitchner, Hiram D. Griffith and Charles O. Ralph.

The Reading Casting Company, Reading, Pa., recently formed with George W. Moore, formerly identified with the J. W. Paxson Company, as president; Samuel Hallowell, vice-president, and H. C. Bell, secretary-treasurer, has acquired the plant formerly occupied by the Grey Iron Foundry Company at twelfth and Mulberry street in that city. The plant has recently been put in operation and the company will make a specialty of light gray iron and hardware castings. It expects to install, in the very near future, sand blast equipment; also the necessary machinery and equipment for hot galvanizing and nickel plating.

The Anchor Post Iron Works, Garwood, N. J., whose local office has been located at 1301 Real Estate Trust Building, has removed to Room 1117 in the same building. W. S. Slack is manager. The company manufactures gates, railings and wire fences.

Chicago

CHICAGO, ILL., May 27, 1913.

The Sulzberger & Sons Company, Chicago, is engaged with the building of a four-story fertilizer building to be 45 x 78 ft., estimated to cost $25,000.

The Crex Patent Column Company, Chicago, has been incorporated with a capital stock of $2,500 by Albert B. Schaffner, 155 N. Clark street; George H. Foster and Elizabeth Anderson, to fabricate steel pipe and structural steel.

The Alamo Incinerator & Mfg. Company, Chicago, organized with a capital stock of $1,000, will manufacture stoves and incinerators.

The Chicago Ferrotype Company, 1457 West Congress street, Chicago, is building a four-story addition to its plant which will cost $35,000.

George F. Marchant, Chicago, for a number of years manufacturer of punches, dies and other fabricators' tools, has incorporated that business as the George F. Marchant Company simultaneously with the removal to a new factory at 1420-1428 South Rockwell street.

The Ford Vacuum Cleaner & Sweeper Company, Chicago, incorporated with a capital stock of $2,500, will engage in the manufacture of vacuum cleaners and sweepers. The incorporators are Gordon J. Booth, J. D. O'Donnell and William Scwemm, 154 West Randolph street.

The Building Appliance Company, Chicago, organized with a capital stock of $2,500 by Stanley Wenz, Jacob Finder and Lemuel M. Ackley, will deal in machinery tools and appliances.

The Commonwealth Adding Machine Company, Chicago, has been organized with a capital stock of $125,000 to manufacture calculating machines and office appliances. The organizers of the company are G. E. Sandstedt, 3162 North Clark street; George Browning and J. C. Tornburgh.

The Farmington Tool Company, Farmington, Ill., has been incorporated to manufacture tools and machinery by Walter S. Harbert, Charles C. Lane and Walter L. Phillips, with a capital stock of $25,000.

The Moline Scale Company, Moline, Ill., has placed the contracts for additions to its plant which will increase the capacity of both machine shop and foundry and double its output. An expenditure of $20,000 is planned.

The Waukegan Fence & Gate Company, Waukegan, Ill., has been incorporated with $15,000 capital stock by H. W. and M. E. Meline and C. Frederick Arthur and will equip a plant for the manufacture of wire gates, etc.

The Westfield Metal Foundry, Westfield, Iowa, has inaugurated operations as a brass, bronze and aluminum foundry under the direction of H. J. Wheelock and J. G. Penne.

The Berwind Fuel Company, Duluth, Minn., has had plans prepared for the building of a machine shop 73 x 122 ft. and to cost $25,000. The repairs of its dock machinery require the facilities thus to be afforded.

F. A. Gahring and J. C. Martin of Minneapolis, Minn., are planning the establishment of an automobile accessory manufacturing operation and for that purpose are negotiating for the plant of the Globe Iron Works at Appleton, Wis.

Cleveland

CLEVELAND, OHIO, May 27, 1913.

Business with machinery houses in the week was generally quiet, purchases being confined almost entirely to single tools. Little in the way of new inquiry developed. For several weeks the volume of business has been quite irregular, orders being quite good for a few days and then being very scarce for a few days. Local builders of locomotive cranes and other handling equipment continue to get a good volume of orders. The labor situation in this territory is causing some concern. Owing to the demand for common labor for outside work much of that labor has been diverted from factories and unusually high wages are being paid for this class of labor. This scarcity is affecting some of the foundries as well as other manufacturing plants. Molders, however, appear to be plentiful. There is a good demand for machinists, which are also rather scarce. At a few points labor troubles are brewing and these may lead to strikes.

The Parish & Bingham Company, Cleveland, maker of automobile frames and other pressed steel stampings will shortly begin the building of a new plant on the site the company recently purchased at West One Hundred and Sixth street and Madison avenue. The plant will be of brick and steel construction, one story high and 100 x 900 ft. Considerable new machinery consisting of toggle presses will be purchased. Later the company plans the erection of a power plant.

The Electric Controller & Mfg. Company, Cleveland, will enlarge its plant by the addition of a wing 50 x 90 ft., four stories and basement and of heavy mill construction. The company is crowded in its present quarters and the additional room would be used to eliminate some of its present factory congestion. No new equipment of any kind will be required.

Corrigan McKinney & Co., Cleveland, have an inquiry out for coal and ash handling equipment for their new steel plant.

The Trussed Concrete Steel Company, Youngstown, Ohio, has purchased 17 acres adjoining its plant on which it is stated it will in the near future erect a large addition.

The Warren Forge & Tool Company, Warren, Ohio, will shortly begin the building of an addition to its plant. The company is running its present plant at double turn and is crowded with work and must provide increased capacity to accommodate its growing business.

The Fire & Gas Valve Company, Cleveland, has been incorporated with a capital stock of $100,000 by J. L. Cannon, L. E. Canfield and others.

The Board of Directors of the Lima State Hospital, Lima, Ohio, will receive proposals June 16 for a machine shop building and its equipment.

The Hurst Mfg. Company, Canton, Ohio, has increased its capital stock from $30,000 to $40,000. The additional capital will be used to increase the capacity of its plant. In addition to making a line of spraying equipment this company has recently gone into the gas engine business.

The city of Cleveland is in the market for a 250-hp. water tube boiler for the infirmary building at Warrensville, Ohio. Bids will be received by C. W. Stage, Director of Public Safety, June 4. On the same day bids will be received by the same city department for an ice making machine for the city tuberculosis sanitarium at Warrensville.

The Morgan & Marshall Co-operative Rubber & Tire Company, East Liverpool, Ohio, has placed a contract for the construction of its new plant for the manufacture of a general line of rubber goods. The building will be 90 x 107 ft., two story and basement, of brick.

The city of Norwalk is planning the erection of a municipal lighting plant, and will shortly place a contract for plans and specifications.

The Gramm Motor Truck Company, Lima, will make important extensions to its plant in the near future.

The plant of the Crestline Aluminum Company, Crestline, Ohio, was burned May 13.

Swift & Co., Chicago, will place contracts about June 1 for the new plant in Lima, Ohio. The building will be a three-story concrete structure, 72 x 175 ft.

The Page Ohio-Michigan Dairy Company will shortly begin the erection of a new plant on Wade street, Toledo, Ohio. This, it is said, will be the first of a series of plants to be built by this company.

The entire plant of the Starr-Hocking Coal Company, Coonville, Ohio, consisting of a coal washery, coal tipple, power house, engines, and other machinery was destroyed by fire May 20, causing a loss of several hundred thousands of dollars. It is stated that the plant will be rebuilt at once.

The Lewis Foundry Company, Toledo, Ohio, has been incorporated with a capital stock of $10,000 by George L. Lewis, William M. Fitzgerald, L. E. Glass, John N. Detzer and C. L. Lewis.

The American Sad Iron & Mfg. Company, Cleveland, has been incorporated with a capital stock of $25,000 by H. J. Alperin, S. L. Rose, Joseph C. Block, and others.

Wheeling

WHEELING, W. VA., May 27, 1913.

The Bridgewater Plow Corporation, manufacturer of garden plows, etc., Bridgewater, Vt., is building a brick factory having a floor space of 9000 sq. ft., which will be completed by August 1. The company has purchased most of its equipment but is now in need of an elevator and a riveting machine.

The Fairmont & Clarksburg Power Company has applied to the West Virginia Board of Public Works for the privilege of constructing a hydroelectric plant. J. W. Fleming, of Fairmont, W. Va., is president.

The West Virginia Paving & Pressed Brick Company, Huntington, W. Va., will make large additions to its plant and increase its capacity.

The City Council of Steubenville, Ohio, has passed an ordinance authorizing the issuance of $200,000 of bonds for the constructtion of a mechanical filtration plant.

The Crescent Window Glass Company, Weston, W. Va., has decided to rebuild factory No. 1, destroyed by fire last February.

The Imperial Glass Company, Bellaire, Ohio, has purchased 300 ft. of ground adjoining its present building and will build a big addition.

The Sharon Coal & Coke Company, Newton, Pa., with chief works in Pike County, Ky., has been incorporated with $100,000 capital stock by Z. T. Vinson, W. R. Thompson, T. J. Bryan, E. M. Watts and A. E. Bush, all of Huntington, W. Va.

The Bastow Glass Company is erecting a plant near Clarksburg, W. Va., for the manufacture of glass bottles and tumblers.

The Dry Run Lumber Company, Durbin, W. Va., has been incorporated with a capital stock of $200,000 to manufacture lumber. Harry E. Clark, John W. McCollough, Miriam W. Band, William C. Bond and Edward H. Sincell, all of Charleston, W. Va., are the incorporators.

The Auto Supply House, Wheeling, W. Va., has been incorporated with $25,000 capital stock to manufacture automobiles, aeroplanes, motorcycles, etc. The incorporators are H. W. Rogers, T. A. Westmyer, John P. Arbenz, Minnie Rogers and Anna B. Westmyer, all of Wheeling.

Cincinnati

CINCINNATI, OHIO, May 27, 1913.

There is no material change in the machine tool trade. Only scattered orders are coming in, but there are indications that there will be considerable railroad buying as soon as the tariff question is disposed of. Export business continues slow, and is not expected to revive before the beginning of the summer season. There is only a fair demand for second-hand machinery.

The Builders' and Traders' Exchange, Cincinnati, has finished remodeling its new quarters at Sixth and Race streets. George W. Welch, recently elected secretary, is conducting a campaign for new members, and expects to enroll all local architects and building contractors at an early date.

The Queen & Crescent Railroad Company, A. Telford, purchasing agent, Cincinnati, will probably purchase additional equipment for its shops at Somerset, Ky., some time in the near future.

Refrigerating equipment will be required by the John Hoffman Packing Company, Cincinnati, for an addition to its plant on Clearwater street.

The Mittendorf Box Mfg. Company, Ironton, Ohio, has acquired a manufacturing building on South Third street, that will be fitted up for the manufacture of wooden boxes. Woodworking machinery, electrical and other special equipment will be required.

The Macdonald & Kiley Company, Cincinnati shoe manufacturer, will soon be in the market for power plant equipment. A sprinkler system will also be installed in the company's factory buildings.

The American Milling Machine Company, Batavia, Ohio, has been incorporated with $10,000 capital stock by P. F. Jamieson, G. R. Wilke, A. V. Carroll and J. F. Dial. Nothing is yet known as to manufacturing plans.

Napoleon de Brul, Cincinnati, is the head of a company now in process of formation, to establish a large pottery plant near South Webster, Ohio.

The Columbus Varnish Company, Columbus, Ohio, has commissioned Architects Howard & Merriam to draw plans for a two-story addition to its present plant.

The Columbus Bolt Works, Columbus, Ohio, has let contract to the McClintic-Marshall Company, Pittsburgh, for an addition to its plant.

S. A. Kinnear, director of public service, Columbus, Ohio, will open bids June 10 for a large lot of electrical equipment.

Steinman & Meyer, Cincinnati furniture manufacturers, have taken out a permit for a large brick addition to their plant on York street.

Boilers and special equipment will be required by the municipality of Clarksburg, W. Va., for a new garbage crematory plant to be erected in that city.

It is rumored that the United States Metal & Culvert Company, whose plant is now located at Birmingham, Ala., has plans under way for moving its factory to Cincinnati.

Work on the addition to the Kennedy Power Building, Cincinnati, will be commenced at an early date. Mention of this was made some time ago.

The McCormick Tile Factory, Gallipolis, Ohio, contemplates adding some additional clay-working machinery.

Detroit

DETROIT, MICH., May 27, 1913.

Better conditions obtain in local machinery circles. The market displays more life and the hesitancy in closing business which has been characteristic for some time past seems to have disappeared. A pleasing feature of the week's business is the betterment in the demand for standard machine tools, the source of which has been the automobile industry. The activity in second hand machinery continues and sales are both numerous and of fairly good sized groups of tools. The demand for power plant equipment is fair. The call for electrical equipment is light, as is that for woodworking machinery. The labor troubles which are prevalent in many parts of the country at present are affecting Michigan to some extent, but so far have had little depressing effect on general manufacturing conditions.

Little change is noted in the foundry trade, although some plants are not as crowded with work as they were earlier in the year. The volume of new construction work continues large.

The Chalmers Motor Company, Detroit, has completed plans for the erection of another large addition to its plant. The new structure will be used principally for manufacturing and will be 60 x 220 ft., four stories and of steel and concrete construction.

J. T. Whitehead, Detroit, has taken out a building permit covering the erection of a two story brick repair shop and garage at Fort street, near Twelfth, to cost $10,000.

The Dongan Electric Mfg. Company, Detroit, will build a new plant at an estimated cost of $5,000.

The Thompson Mfg. Company, Holland, Mich., manufacturer of bathroom fixtures, is installing additional machinery and will add the manufacture of general furniture to its line.

The lumber mill of the Mashek Lumber Company, Escanaba, Mich., was completely destroyed by fire May 15, entailing a loss of about $6,000.

The Grand Trunk Railroad has announced plans for the erection of a large roundhouse at its Nichols yards, Battle Creek, Mich. A repair shop for the making of minor repairs may also be built.

The Big Rapids Water Power Company, Big Rapids, Mich., has started preliminary work on the construction of a new power plant. H. J. Emmons is the engineer in charge.

The National Cable & Mfg. Company, Niles, Mich., is to enlarge its scope by the acquisition of a company manufacturing railroad supplies. The present plant will be somewhat enlarged but no new equipment will be required at present.

The American Metal Weather Strip Company, Grand Rapids, Mich., has been reorganized with $18,000 capital stock and has acquired new factory quarters. The officers are E. D. Dickinson, president, and A. E. Gould, secretary and general manager.

The Alma Standard Foundry Mfg. Company, Alma, Mich., has been incorporated with $5,000 capital stock to conduct a general foundry business.

The capital stock of the Henry Rowe Mfg. Company, Newaygo, Mich., manufacturer of automatic lathe trimmers, dowells, etc., has been increased from $10,000 to $25,000.

Indianapolis

INDIANAPOLIS, IND., May 27, 1913.

The Indiana Mosaic Flooring Company, Indianapolis, has been incorporated with $150,000 capital stock, to manufacture tile flooring. A plant will be established under the supervision of Spanish experts. The National Mosaic Company has a similar factory at Mobile, Ala., and William F. Tebbets of that city will be secretary-treasurer of the Indianapolis company. Lee R. Finehout, Indianapolis, is president, and George D. Lessene, Mobile, vice-president.

The Halstead Construction Company, Indianapolis, has been incorporated with $10,000 capital stock, to build bridges, buildings, etc. The directors are W. C. Halstead, W. V. Halstead and C. B. Clarke.

The Link Belt Company, Indianapolis, has taken out permits for three factory buildings for a malleable iron plant. The largest building will be the annealing house, costing $25,000. There will be provision for 12 annealing furnaces. A second building will be an annealing pot foundry and the third is for storage purposes.

The American Creosoting Company, Indianapolis, has taken out a permit for its new plant at Earhart and Minnesota streets.

The Columbia Conserve Company, Indianapolis, will build a new power plant requiring two tubular boilers, equipped with chain grate stokers.

The site for the Crawford & McCrimmon Company's foundry and machine shops has been disannexed from the city of Brazil, Ind., and the building of the new plant will be begun at once.

The Auburn Mfg. Company, Auburn, Ind., has increased its capital stock from $20,000 to $40,000.

The Delaware Brass & Aluminum Company, Muncie, Ind., has been incorporated with $10,000 capital stock, to manufacture and deal in metal products. The directors are John Beckett, P. J. Casey and George Simmons.

The W. T. Thompson Veneer Company, Edinburg, Ind., has been incorporated with $35,000 capital stock, to manufacture veneer and lumber products. The directors are W. T. Thompson, Bedna Young and F. M. Cutsinger. A plant will be built.

The Wolcottville Cement Products Company, Wolcottville, Ind., has been incorporated with $10,000 capital stock, to manufacture cement and its products. The directors are J. H. Yeager, J. F. Holsonger and G. F. Eshelman.

It is reported that Frank and Perry Remy, former heads of the Remy Electric Company, manufacturer of magnetos, Anderson, Ind., are now perfecting an oil engine to compete with gasoline engines in automobiles and for other purposes. The factory will be in Anderson. The Morrison oil engine is now being manufactured at the Anderson Foundry & Machine Company's plant.

Milwaukee

MILWAUKEE, WIS., May 26, 1913.

Machine tool builders have profited by the conservative tone of the heavy machinery market, inasmuch as the labor situation is improved, due to the slight retrenchment made by some large manufacturers. The number of available men has increased in this manner, but they are immediately re-employed and the tool production is becoming more commensurate with the demand, in which there has been as yet no sign of a let-up. No particular worry attaches to the retrenchment by heavy machinery people, as this is a common situation at this period. Small and single lot business continues to be the rule in the tool trade and there is nothing extraordinary big in sight at present. As before, the shops are working at top speed and expect to continue in this manner indefinitely. Automobile factories are coming into the market more strongly than for some months.

W. S. Woods, of La Crosse, Wis., has purchased a large interest in the Chicago Steel Tape Company, Chicago, founded by L. A. Nichols to manufacture engineers' and surveyors' supplies and specialties, and the works are now being moved to La Crosse, occupying the Hogan block at 122-124 South Front street. The new works will employ about 35 skilled mechanics.

The Hewitt Machine Company, Neenah, is making improvements, including the installation of a large grinder with a capacity of 26 x 160 in., for turning rolls for paper mills.

The citizens of Menomonee Falls are raising a fund to purchase a site for a gray iron foundry, which is the requirement specified by the Nelson Foundry Company, North Milwaukee, to move from the Milwaukee suburb. The Nelson foundry was badly damaged by fire two months ago. The main building will be 100 x 200 ft., of reinforced concrete. The capacity of the cupola will be 6 tons per day.

The Wisconsin & Michigan Railroad Company is changing the entire drive of its car and locomotive shops, machine shop, repair works and other buildings at Peshtigo from steam to electricity.

A new factory building 40 x 48 ft., of concrete, will be built by the Wisconsin Farm Implement Company, Beloit. The company was organized a few months ago by George B. Slater and George W. Marsden, upon disposing of their interest in the Slater-Marsden-Whittemore Company, manufacturer of punches, shears, rolls and woodworking machinery. They retained a unit of the holdings and engaged in the manufacture of farm implements. The capacity of the plant has been reached and the addition is being rushed to completion.

The Racine Water Company, Racine, is considering the installation of a complete filtration plant, with the alternative of extending its intake into Lake Michigan. The filtration plant would entail an expenditure of more than $100,000.

W. R. Taylor, 2827 Washington avenue, Racine, has organized the Racine Detachable Hinge Company, with a capital stock of $16,000, to manufacture hinges and latches designed by A. J. Piker and F. W. Heeter, who are associated with him in the enterprise. A small factory, equipped with punches, drills, lathes and presses will be established.

A complete new brewing and malting plant will be erected by the Calumet Brewing Company, Chilton. Two units will be constructed and equipped this year and the remainder in 1914.

The Winckler Engineering Company, Racine, has been organized with a capital stock of $15,000. The concern will engage in general structural engineering and mill, shop and factory equipment. The incorporators are A. E. Winckler, V. H. Whaley and M. E. Walker.

The plant of the Harris Typewriter Company, Fond du Lac, sold at foreclosure last week to F. J. Rueping, representing the bondholders, for $60,000, is being overhauled in preparation for a speedy resumption of operations. While the plant was never entirely shut down during the litigation, operations were somewhat curtailed.

The Wisconsin Condensed Milk Company Refrigerator Line has been organized with a capital stock of $10,000 by F. H. Hastings and Lewis H. Rohr and C. B. McCanna of Burlington, president of the Wisconsin Condensed Milk Company.

The Holland Flexible Auto Wheel Company, Antigo, has been incorporated with a capital stock of $10,000 to manufacture a new type of wheel for motor trucks. The incorporators are Thomas J. Holland, James L. Donahue and John E. McKenna.

The Central South

LOUISVILLE, KY., May 27, 1913.

Business in this territory remains generally satisfactory, though irregular and spotty. Some lines of trade are experiencing a good demand, while others are showing weakness. Power equipment is not selling as well as heretofore, boiler makers in some instances devoting themselves to tank and special work instead of their usual line, while handlers of electrical equipment report a falling off in the demand. Motor-driven machine tools, however, have been selling well. A somewhat stronger demand for export purposes is reported though English business has been interfered with, according to statements from sales agencies there, by labor and other troubles. Prospects for machine tool business are good, as a number of metal working concerns in this section are planning expansions.

The Henry Vogt Machine Company, Louisville, reports the demand for ice machinery fair. It has received an order from British India for a 10-ton machine, being the seventh which has been sold to the same buyer.

The Mengel Box Company, Louisville, recently purchased for installation in a new factory at Winston-Salem, N. C., a complete outfit of grinding room equipment from the Hanchett Swedge Works, Big Rapids, Mich. The sale was made through Charles L. V. Frank, a local dealer.

The Crown Motor Car Company has established temporary quarters at 121 North Third street, Louisville, where equipment will be installed for doing experimental work. Later on a larger plant will be established for the manufacture of a popular-priced two-passenger automobile.

Thomas L. Barret, dealing in contractors' equipment, has moved his quarters from the Board of Trade Building to 127 North Third street, where he is carrying a large stock of power machinery, concrete mixers and other contractors' supplies.

The J. V. Pilcher Mfg. Company, Gray and Shelby streets, Louisville, is having plans drawn by Architect Frederick Erhart for an addition to its plant. It manufactures metal butons. Officers of the company have advised that transmission equipment will cover the principal requirements.

The Auburn Light & Water Company, Auburn, Ky., has advised that it is ready to receive estimates on the installation of equipment in an electric light plant. Charles E. Bates is in charge.

Paducah, Ky., is planning the installation of additional pumps in its water plants. These will be electrically driven, current being furnished from the municipal plant. On account of the increased demands upon the latter, additional engine and generating equipment will be needed.

The Paintsville Water Company, Paintsville, Ky., has acquired a site for its pumping station and is ready to proceed with the construction of its plant. It secured a franchise some time ago.

The Woods-Ford Company, Lawrenceburg, Ky., will enlarge its garage and automobile repair shop.

R. W. Darnell, Scott Glascock and M. M. Rhodes, Flemingsburg, Ky., will erect a loose leaf tobacco warehouse at a cost of $20,000. Scales, presses, elevators and other equipment will be needed.

The Independent Coal Company has been organized at Hickman, Ky., and will install a large electric crane with conveying equipment for moving coal from river barges to its yards. John T. Dillon is manager of the company.

The Louisville & Nashville Railroad, with general offices in Louisville, is reported to be planning the opening of a large stone quarry near Elizabethtown, Ky., for the purpose of supplying material to be used in construction work.

The city of Memphis, Tenn., will construct a garbage incinerator, it is announced. Dr. M. Goltman, superintendent of the board of health, has plans in charge.

J. K. Kenton, 615 Market street, and others, Chattanooga, Tenn., have leased a building which is to be equipped for the manufacture of shoes.

Miss Eleanor Spofford, Nashville, Tenn., is having a carriage factory built, John Read being the architect. Equipment will be purchased, including motors, woodworking machinery, etc.

It is reported that the Metal Products Company of Birmingham, Ala., will erect a branch plant at Memphis, Tenn., at a cost of $20,000.

The Chickasaw Machine & Foundry Company, Memphis, Tenn., has been incorporated with $20,000 capital stock. The incorporators are Thomas L. LaMalta, Frank Schumann, Edward Abele, Matthew Dwyer and William H. Irwin.

R. W. Banks, Jr., Gulfport, Miss., is planning the equipment of a shop to manufacture a device for sharpening blades automatically.

The Crescent Bed Company, Ltd., New Orleans, La., has taken out a permit to build a $25,000 factory, which will be four stories and of brick construction.

The Gressner & Groh Electric Welding Company, New Orleans, La., is planning the establishment of a welding plant, with power equipment, at Mobile, Ala., at an estimated cost of $5,000.

The Decatur Cornice & Roofing Company, New Decatur, Ala., is reported to be in the market for a crimping machine for use in handling sheets for cornice work.

The Montague Mfg. Company, Richmond, Va., is to equip a planing mill, and is in the market for boilers, engines, woodworking machinery, dry-kiln equipment and other necessary appliances. Sash and doors will also be made, requiring glue room equipment, including spreaders, presses, etc. Stewart M. Woodward is president of the company.

The Charlottesville & Albemarle Railway Company, Charlottesville, Va., will purchase three 400-hp. high pressure boilers, with condensers, pumps, etc. John L. Livers is manager of the company.

George A. Kershner, Martinsburg, W. Va., will build an automobile garage and repair shop. Two elevators will be installed.

Texas

AUSTIN, TEXAS, May 24, 1913.

The machinery and tool trade continues active, and dealers are well satisfied with the situation.

The Davidson-Bronstead Gin Company will build a cotton gin at Clifton.

The Mount Pleasant Electric Light & Power Company will enlarge and otherwise improve its electric light and power plant at Mount Pleasant, at a cost of about $175,000.

The Alma Farmers' Gin Company, Alma, has been organized for the purpose of erecting and operating a cotton gin. W. J. Hickman, T. S. Smith and J. N. Lennan are incorporators.

The Averill Gravel Company, Beaumont, is opening a gravel bed at Cuero and will install machinery with a capacity of 30 carloads a day for excavating, washing and loading the material.

The La Porte Light, Water & Ice Cream Company will soon begin the construction of an ice factory and cold storage plant at La Porte.

The Farmers' Cotton Oil Mill Company has purchased a site and will build a cotton oil mill at Rogers, at a cost of $50,000. C. A. Crouch is president; J. A. Williams, secretary-treasurer and Thomas C. Webb, manager.

The Farmers' District Union & Gin Association will build a cotton gin at Rule. R. N. Smith is interested.

The Clear Spring Farmers' Union Gin Company, Clear Spring, has been organized for the purpose of erecting a cotton gin. Rudolph Zipp is interested.

The Edna Electric Light, Ice & Water Company will erect an electric light and waterworks plant at Edna, and will also put up a cotton gin. L. E. Ward is interested.

The Farmers' Gin Company is preparing to build a cotton gin at Melissa. A. L. Shirley, S. H. Paris and J. R. Neal are interested.

The Texas Grain & Elevator Company has been organized at Fort Worth, Texas. The incorporators are: E. M. Rogers, J. B. Rogers and G. H. Rogers.

It is announced by A. B. Axtell, chief engineer of the Guadalupe Traction company, which is about to build an interurban electric railroad, will also erect a large hydroelectric plant on the Guadalupe River near Seguin. The power for operating the road will be obtained from this plant. The incorporators named in the company, are a group of wealthy eastern Texas men, headed by Dr. E. W. Brown, of Orange.

A municipal waterworks plant and distributing system are being constructed at Archer City.

The Texas & New Orleans Railroad has begun the construction of new machine shops and other buildings at Beaumont. The improvements will cost about $65,000.

Phelps-Dodge & Co., who own the Chemung Copper mine at Tyrone, N. M., will build a large electric power plant for operating the pumps of the mine and for running the cars through the tunnel that connects the Chemung with the Leopold mine.

The Pierce-Fordyce Oil Association is building a paraffine wax factory at its oil refinery at Texas City. It is reported that this company will also greatly enlarge its refining plant.

The Paris Box & Mfg. Company will construct a veneering mill at Paris.

St. Louis

ST. LOUIS, MO., May 26, 1913.

The business of the past week in the machine tool market was chiefly for single tool requirements, with an occasional request for second-hand machines. The aggregate was fairly satisfactory, all things considered, but the general trend seems to be toward conservatism in extensions and in replacements as well. No very specific reasons are being cited for the rather light business, light considering the general business conditions in this territory.

The Williamsville Roller Mill Company, Williamsville, Mo., with $10,000 capital stock, has been incorporated by W. L. Rhodes, C. E. Sharp and E. Rhodes, and will equip a plant at once.

Fire at Leavenworth, Kan., May 22, destroyed the pattern house of the Great Western Mfg. Company and the plant of the J. Brown Lime & Cement Company, with a total loss of $50,000. Replacement plans have not been announced.

The Woodlinx Fixture Company, St. Louis, with $50,000 capital stock, has been incorporated by Isaac W. and Milton Miller, M. Jenkins and M. G. Levinson, and will equip for the manufacture of store fixtures, etc.

The Nu-Back Mfg. Company, St. Louis, with $15,000 capital stock, has been incorporated by Edmund V. Wilkinson, Adam Wiest and Culver L. Halstedt, and will equip a plant for the manufacture of paints and varnishes.

The Spiesbach-Anderson Mfg. Company, East St. Louis, Ill., has been incorporated by Edward J. Spiesbach, Christ Anderson and Theodore C. Anderson and will equip a $20,000 planing mill plant shortly.

The National Lead Mine Company has begun the equipment of a lead mining property at Des Arc, Mo., and will add machinery for the development of the tested ore bodies.

A company of which George C. Grumbaugh of St. Louis is president has been organized to equip a plant at 5122 North Second street, St. Louis, for the manufacture of a patented lath material.

The August F. Weinel Lumber Company, Columbia, Ill., with $15,000 capital stock, has been incorporated by August F. Weinel, Ernest A. Weinel and B. Weinel, and will equip a planing mill.

The Dairy Oil & Gas Company, Muskogee, Okla., with $30,000 capital stock, has been incorporated by John H. Moiser, R. T. Colter, W. D. Cornelius and A. C. Trumbo, and will install equipment for the development of property controlled by them.

The Winona Oil & Gas Company, Oklahoma City, Okla., with $30,000 capital stock, has been incorporated by A. A. Humphrey, F. A. Jennings, Theodore Stockdell, E. C. Thorne and F. L. Mulky, and will equip for the development of property which they have acquired.

The Red River Coal & Mining Company, Leslie, Ark., has been organized by G. S. Thompson, Ed Mays and A. G. Killibrew, with $100,000 capital, to equip for the operation of a coal vein. Complete modern machinery will be installed.

The Commercial Club, of Ardmore, Okla., has entered the market for a 100-machine knitting mill, offering a bonus of $10,000 conditioned on a five year guarantee of operation.

The Tall Timber Company, Texarkana, Ark., will build a $250,000 mill at Good Pine, La., with a daily output of 150,000 ft. of lumber.

Helwig & Cole, St. Benedict, La., have plans for a canning plant with a daily capacity of 800 dozen cans of fruits and vegetables.

Definite decision to establish a cannery at Seguin, Tex., has been reached by the Seguin Canning Factory Company, organized by George Atzger, Julius Fritz, Sinclair Moreland and others.

The Nowata Star Brick & Silo Company, Nowata, Okla., with $15,000 capital stock, has been incorporated by E. G. Eby, J. O. Cody and E. L. Eby, and will equip for the manufacture of bricks at once.

The Farmers' Custom Gin Company, Bristow, Okla., recently incorporated with $15,000 capital stock by W. O. Baker, A. W. Dunham and others, will equip an eight stand gin, compress, power plant, etc.

A cotton gin will be built in time to handle the growing crop at Marlow, Okla., by D. F. Dempsey.

The Farmers Co-operative Gin Co., Stonewall, Okla., with $12,000 capital stock, has been incorporated by Albert Gill, J. A. Westbrook or Stonewall, R. L. Rogers of Frisco, Okla., and F. H. Flippen of Jessie, Okla., and will equip a plant at once.

The Ash Grove Milling & Electric Company, Ash Grove, Mo., is in the market for oil storage tank equipment, pumps, etc.

Machinery being sought by the Kimball-Lacy Lumber Co. at Arkansas City, Ark., includes a 4-saw edger, 2-cylinder nigger, automatic trimmer and other similar equipment for the new plant contemplated there.

The H. D. Williams Cooperage Company, St. Louis, will equip a cooperage plant at Searcy, Ark., where it has acquired a 60-acre site.

The Salle Bros.' handle factory at Pocahontas, Ark., is reported burned with $10,000 loss. Replacement plans have not been announced.

The Lafayette Motor Car Company's repair shop, with equipment at Lafayette, La., is reported burned with a loss of $30,000, largely on equipment.

The Danville Electric Company, Danville, Ark., of which C. O. Meadows is manager, is reported to be in the market for additional power equipment.

A. G. Swanson & Company, New Orleans, La., have plans for the equipment of a match factory and are in the market for the necessary machinery.

The Gulf Naval Stores Supply Company, New Orleans, La., with $100,000 capital stock, incorporated by Robson Dunwoody, Charles B. Branan and Evans B. Robson, will equip fireproof steel distilleries for turpentine and rosin and is in the market for equipment.

The Schram Glass Mfg. Company, St. Louis, has plans for increasing its equipment for the manufacture of a self sealing device for glass jars, and will increase its capital stock from $500,000 to $600,000.

Birmingham

BIRMINGHAM, ALA., May 26, 1913.

Outside of a trades strike at Birmingham affecting building operations and causing a falling off in the current demand for small goods, the machinery trade maintains an excellent equilibrium. For the dullest period of the year the business in boilers, engines and pumps is reported as above the normal. Renewal of construction work at the Ensley wire mill and additional developments in the coal and ore field will add to the demand for a variety of goods.

The Spruce Pine Pottery Company, Spruce Pine, Ala., is completing plant and will begin shipping at an early date. Clifford J. Scharnagel is manager.

The Lucas Moore Stave Company, Mobile, Ala., is completing a stave plant with a capacity of 75,000 staves. Two 90-hp. engines will supply power. Lucas E. Moore, Columbus, Miss., is president and E. C. Graces, of Mobile, general manager.

The Mobile Box Lumber Company organized by John B. Miller, New Orleans, and James G. Varley and J. M. Good, Chicago, will build a factory for the manufacture of boxing material and lumber for sashes, doors, etc., at Chrichton, Ala.

The Marbury Lumber Company, D. H. Marbury, Ala., president, is proceeding to develop 42,000 acres of timber land.

The Aliceville Electric Company, Aliceville, Ala., will build an electric lighting plant to cost $6,500. William F. Wolf, engineer.

The Greensboro Cotton Oil Company, Greensboro, Ala., will install additional gins.

The Franklin Light & Power Company will build electric lighting plant in Bowersville, Ga., and install lighting system.

The L. B. Skinner Mfg. Company, Dunedin, Fla., has been incorporated with a capital stock of $10,000 by L. B. Skinner, B. C. Skinner and William Hunter to manufacture washers, dryers and other packing house machinery.

The Pearson Mfg. Company, Pearson, Ga., G. W. James, general manager, will establish a saw and planing mill.

Eastern Canada

TORONTO, ONT., May 24, 1913.

The Colborne Canning Company, Ltd., has been incorporated with $40,000 capital stock to conduct a canning factory at Colborne, Ont.

The Brantford Machine & Foundries, Ltd., Brantford, Ont., has been incorporated with a capital stock of $40,000 by Herbert Burns Rowell, Frederick D. Green, Carl B. Smith, R. B. Hawkins and William Hollinrake. The company will purchase the exclusive rights to manufacture and sell an automatic wood molding machine.

The Dyer Fence & Supply Company, Ltd., Toronto, has been incorporated with a capital stock of $40,000 to manufacture machinery and electrical equipment. The company will also manufacture wire and iron fence, posts and gates. The incorporators are E. L. Dyer, William Huth, C. B. Huth and Edgar Armstrong.

A new factory will be built on Broadview avenue by the Industrial Buildings, Ltd., Toronto, for the use of the United Drug Company, Ltd. The estimated cost of the building and the site is about $150,000.

The Kelsey Wheel Company, Windsor, Ont., which recently purchased property in the factory district, will soon start work on the building of its plant. From the reports of members of the company the plant will be the largest in Windsor and is expected to employ more men than any other concern in that city.

The National Drug & Chemical Company, Toronto, which is now erecting a five-story factory building on Phoebe street, at a cost of $90,000, has decided to erect a five-story warehouse adjoining, also at a cost approaching $90,000.

The Panther Rubber Company, Stoughton, Mass., has arranged to locate at Sherbrooke, Que. The usual privileges of exemption of taxation, etc., have been granted. The company has purchased the factory recently vacated by the Sherbrooke Iron Works Company, the latter having moved to another site in Sherbrooke. The Panther Rubber Company manufactures rubber heels, soles and a quantity of other rubber goods and is financed entirely with American capital. Operations will start about the middle of July.

The Canada Glass Corporation, Ltd., Montreal, has, it is stated, been formed with an authorized capital stock of $8,000,000. It will take over the Diamond Glass Company, the Sydenham Glass Company and the Canadian Glass Company.

The Cumberland Brick & Tile Company, Amherst, Nova Scotia, has been formed with a capital stock of $250,000.

The Dominion Tire Company has decided to erect additional buildings to its plant at Berlin, Ont. The plant, which is in the north ward, will be ready in December

The factory and plant of the Erie Iron Works Company, St. Thomas, Ont., was partly destroyed by fire. The loss from fire and water will be about $5,000.

Work was started this week on the new factory of the Tillsonburg Electric Car Company, Tillsonburg, Ont. Members of the company and employees and their families have moved to Tillsonburg. Among these are T. J. Bailie, president, and J. A. Bailie, who will have charge of the electrical department. William Russ, secretary-treasurer.

The Otis-Fensom Elevator Company, Hamilton, Ont., has planned for extensive additions to its factory. A one-story addition, 70 x 140 ft., will be started at once at an estimated cost of $20,000. It will be of fireproof construction, metal sash and tile roof. The company will also build a brass foundry with a floor space of 9000 sq. ft., one story, and a pattern and storage warehouse, two stories and basement, 70 x 100 ft.

The Perolin Company, of Canada, Toronto, has been incorporated with $50,000 capital stock to manufacture and deal in machinery and special appliances. Francis H. Stewart, Wilbert Willis and Howard Anderson, Toronto, are the incorporators.

Western Canada

WINNIPEG, MAN., May 23, 1913.

The local machinery companies report business increasing with the excellent crop outlook and more reasonable conditions. There is a better feeling in industrial circles. Many were undoubtedly holding back, awaiting the crop prospects. Observers of the situation throughout the western provinces of Canada are of the opinion that the increase in manufacturing industries here in 1913 will not be much, if any, behind the substantial gain of 1912. There is a slightly better feeling in the money market, although there is considerable tightness yet. This, however, does not affect regular business as much as it does speculators. Many houses report collections gradually improving.

The voters of Melita, Man., have indorsed the by-law to grant a 30-year franchise to R. E. Denny, of Brandon, Man., to supply the town with natural gas, artificial gas, a heating system, electricity and waterworks.

C. A. Haines & Co. have bought the flour mill of Stenerson Bros., Hazel Dell, Sask., and intend putting in a larger plant in the fall.

The Maritime Nail Company, Ltd., which is building a manufacturing plant at Fort William, has increased its capital stock, and it is said will put in a much larger plant than was at first intended.

The Canadian Pacific Railway contemplates building machine and repair shops in the near future at Wilkie, Sask., at an approximate cost of about $180,000.

The voters of Medicine Hat, Alberta, have indorsed by-laws involving the expenditure of $223,000 on extension to gas system, $85,000 on waterworks plant, $17,000 on fire apparatus and $170,000 on electric plants.

The Belly River Lumber Company, Lethbridge, Alberta, will build a modern planing mill, and improvements on the lumber mill are now under way.

Niven Bros., Lethbridge, Alberta, will erect a foundry. It will have a department for brass work.

The citizens of Saskatoon, Sask., have voted to spend $150,000 on extending the electric light and power system.

Heathfield, Hammond & Thomas, lately from Toronto, have decided to erect a large brickmaking plant at Davidson, Sask., where they have found excellent clay.

The Council of South Vancouver, B. C., is contemplating establishing a municipal gas and electric plant.

The ratepayers of Russell, Man., have voted to spend $18,000 on the installation of an electric light plant.

The Anglo-American Filtering Company will erect a filterizing plant in Winnipeg, at a cost of between $15,000 and $20,000.

William Rutherford and J. Merriam, Medicine Hat, Alberta, are preparing to start a woodworking industry. They propose spending about $15,000 on machinery.

The Board of Control of Winnipeg is contemplating spending $7,000,000 on a waterworks scheme. A by-law to establish a Greater Winnipeg Water District was recently passed. The engineers are Stearns, Herring & Fuertes.

The Alberta Farmers' Association contemplates building about 30 grain elevators this year in different parts of the province, and it is expected that the Saskatchewan Cooperative Elevator Company will erect more than 50 elevators.

It is announced that the Phoenix Mfg. Company, Eau Claire, Wis., will erect a tractor manufacturing plant in Moose Jaw, Sask. The company will incorporate here as the Canadian Phoenix Tractor Company, Ltd.

D. F. Brooks, St. Paul, Minn., president of the Powell Paper Company, Powell River, B. C., is reported as saying that his company will probably erect a new lumber mill and shingle mill near the company's plant, to handle by-products of the paper plant and such timber as is available in that neighborhood.

Three by-laws aggregating $480,000 were passed at Kamloops, B. C., including extensions to waterworks, $100,000; extensions to electric light system, $120,000, and $260,000 for the hydroelectric power plant.

The Ogilvie Milling Company has let a contract for a 50,000-bushel elevator to be built at Bassano, Alberta.

The Alloy Steel Casting Company, Warwood, W. Va., has been reorganized and will be hereafter known as the Wheeling Steel Casting Company. The plant will be enlarged and improved.

Government Purchases

WASHINGTON, D. C., May 26, 1913.

The Paymaster-General, Navy Department, Washington, will open bids June 3 for equipment to be delivered to Pearl Harbor, Hawaii, as follows:

Schedule 5414, Class 41, one dry-kiln equipment; class 42, standard portable industrial railway track and six cars.

Schedule 5416, two adjustable bar folders, one slip roll former and one wiring machine.

Schedule 5419, class 54, one band saw sharpener, one band saw stretcher, one brazing table and one combination rip and cross cut circular saw sharpener.

Schedule 5420, class 56, for furnishing and installing one motor-driven shaving exhaust system in woodworking shops.

The Paymaster-General, Navy Department, Washington, will open bids June 3, under schedule 5417, classes 46 to 52 inclusive, for a quantity of reversible and non-reversible pneumatic machines, including eight pneumatic woodworking machines, 80 scaling hammers, 23 hammers, two bottom riveters, two jam riveters and five short holders-on.

The War Department, United States engineer office, Montgomery, Ala., will open bids June 20 for lock gates, filling and emptying valves, gate maneuvering gear, etc.

The United States engineer, first and second districts, Mississippi River Commission, Memphis, Tenn., will open bids June 23 for furnishing and delivering three complete ice and refrigerating plants.

The Commissioners of the District of Columbia, Washington, will open bids June 2 for furnishing and delivering one motor-driven lathe for use in the fire department.

The Department of the Interior, Washington, will open bids June 5 for furnishing and installing one 350-kw. engine and generator, water-tube boiler and mechanical stoker, also for the relocating, extending and connecting switchboard in engine room at the old post office, Washington.

The United States Marine Corps will open bids June 2, under requisition No. 1709, for furnishing one setting-down machine, one double-seaming machine, one rim machine, one wiring machine and one turning machine.

The Daily Consular Reports issued by the Bureau of Foreign and Domestic Commerce contain a number of foreign trade opportunities of which abstracts are given below:

No. 10,976—An American consular officer in a European country states that a local concern is now in the market and asks proposals for the sale and delivery of American railroad supplies.

No. 10,981—The American consulate general at Rio de Janeiro, Brazil, reports that bids for the installation of four large rubber factories will be received at the Department of Public Works, Rio de Janeiro, June 23.

No. 10,982—The American consul at Moncton, N. B., reports that a piano manufacturing company is about to build a factory and desires catalogues, quotations, etc., from American manufacturers of piano making equipment.

No. 10,987—A foreign municipal engineer now testing an American electric motor truck will recommend the purchase of a half-dozen trucks of different makes to compare their efficiency. After tests are completed 25 trucks will be required.

No. 10,988—An American consul in Brazil has had an inquiry from a local concern for information as to the piling of bags of coffee in warehouses with portable elevators and conveyors and requests that American manufacturers of such equipment send him catalogues and other information.

No. 10,991—An American consul in Canada states that a community in his district is about to take up brick and tile making. It will shortly be in the market for machinery for a moderate sized plant.

No. 10,994—An American consul in a European city has had inquiries from dealers of marble and stone for machinery for the manufacture of cement briquettes. A print of the machine desired can be obtained from the department. Correspondence should be in Italian or German.

The Bureau of Supplies and Accounts, Navy Department, Washington, opened bids May 20 for material and supplies for the navy yards as follows:

Schedule 5384, class 21, one motor-driven single action inclinable punch press—Bidder 21, E. W. Bliss Company, Brooklyn, N. Y., $1,087 and $1,160, alternate; 70, William Hibbard Mfg. Company, Brooklyn, $1,025; 101, Niles-Bement-Pond Company, New York, $1,060; 124, D. H. Stoll Company, Buffalo, N. Y., $870; 138, Toledo Machine & Tool Company, Toledo, Ohio, $914; 164, Zeh & Hahnemann Company Newark, N. J., $1,100; 175, Prentiss Tool & Supply Company, New York, $660.

Schedule 5385, class 31, one Rockford motor-driven direct connected No. 2 horizontal drilling and tapping machine—Bidder 60, Fairbanks Company, Washington, D. C., $1,220; 166, Kemp Machinery Company, Baltimore, Md., $1,365.

Class 32, one double surfacing machine—Bidder 2, American Woodworking Machine Company, Rochester, N. Y., $2,875; 11, Berlin Machine Works, Beloit, Wis., $3,050; 55, J. A. Fay & Egan Company, Cincinnati, Ohio, $3,180; 94, Manning, Maxwell & Moore, New York, $1,970 and $1,990; 150 S. A. Woods Machine Company Boston, Mass., $2,964.70.

The plant of the Sintered Ore Company, located near the blast furnace of the Buffalo Union Furnace Company, Buffalo, is now in operation to the extent of three of the five furnaces. The remaining two will be ready in a short time. The Greenawalt process is employed.

Trade Publications

Drilling Machines.—Francis Reed Company, Worcester, Mass. Circular. Pertains to a modernized line of bench and column drilling machines, which are made in two sizes, having swings of 14 and 20 in., respectively. These machines are improvements on the ones which the company has been building for some time, and in the new design several important changes have been made. An illustrated description of these drills which can be arranged for foot operation in both types appeared in *The Iron Age*, February 27, 1913.

Automatic Lathe.—Jones & Lamson Machine Company, Springfield, Vt. Flexible leather covered booklet. Size, 5 x 7 in.; pages, 45. Pertains to the Fay automatic lathe, which is a machine for the automatic turning of work held in centers or on centered arbors. The book is something more than the ordinary piece of trade literature and is written in a very different style. After a discussion of the problem of handling lathe work properly under manufacturing conditions, a description of the tool which is a real lathe, with headstock, tailstock, carriage and bed, but differs from the engine lathe in the details of its mechanism, which fit it especially for the particular work it is designed to do, is given. This description is supplemented by a number of engravings of the tool and its various parts, and in conclusion the advantages of it, such as ease of setting, rapidity of changing work, multiple tooling, the production of two pieces at a time and flexibility of mechanism, etc., are discussed. A number of drawings of typical operations performed by the lathe are also included.

Locomotive Cranes.—Brown Hoisting Machinery Company, Cleveland, Ohio. Catalogue L. Gives a brief description of the Brownhoist locomotive crane and shows by illustrations how it is used at blast furnaces, mills and mines. After a short general description of the crane, views are given of it in use. Mention is also made of a portal pier type crane and a two-rope ore grab bucket for use with the crane, and clearance sketches of the 10 and 15 ton locomotive cranes are included.

Radial Brick Chimneys.—Heine Chimney Company, 72 West Adams street, Chicago, Ill. Booklet. Presents with numerous illustrations some actual installations under practical conditions of an interlocking radial brick chimney which is built in a number of different sizes. These chimneys are in use with boilers, kilns, coke ovens, smelters, blast furnaces, crematories and refuse destructors. In connection with each illustration, the dimensions of the chimney and the purpose for which it is used are given. A partial list of users, arranged alphabetically by states and towns, is also included.

Ladle Stoppers.—Joseph Dixon Crucible Co., Jersey City, N. J. Booklet. Devoted to a description, with illustrations, of plumbago stoppers, nozzles and sleeves. One of the special features claimed for these stoppers is that the grain runs longitudinally and thus renders the stopper less apt to pull loose when the stopper head freezes to the nozzle.

Recording Meters, Thermometers and Electric Furnaces.—Bristol Company, Waterbury, Conn. Two bulletins and two catalogues. Bulletin No. 143 and catalogue No. 173 illustrate and describe recording differential pressure gauges and flow-rate meters of the spring tube and float types which were illustrated in *The Iron Age*, April 17 and May 15, 1913, respectively. In this bulletin and catalogue the construction of the instruments is described, together with engravings of the instruments and the different types of charts which can be furnished. Bulletin No. 170 treats of an electric furnace for heating soldering coppers for use on 110 and 220 volt circuits, the windings being such that a suitable temperature for the copper inside the heating chamber will be established and maintained. Catalogue No. 1300, superseding bulletin No. 127, relates to the different forms of Class III recording thermometers that can be furnished. These are illustrated and briefly described, together with the various accessories, such as connection bulbs and charts. Reproductions of the latter are given and full instructions for applying the thermometer are also included. An illustrated description of this thermometer appeared in *The Iron Age*, January 19, 1911.

Carboy Tilting Device.—Carboy Inclinator Company, 1269 Broadway, New York City. Describes and illustrates the Flaherty carboy inclinator, which is designed for attachment to a wooden carboy case to enable the carboy to be tilted and its contents poured out without danger from spilling or splashing. Views of the successive stages from the clamping of the inclinator to the emptying of the last drop in the carboy are given. An illustrated description of this device appeared in *The Iron Age*, February 27, 1913.

Spring Machinery.—Sleeper & Hartley, Worcester, Mass. Bulletins Nos. 252, 254, 260, 261, 264, 268 and 270. Illustrations and descriptive matter in each bulletin explain the operation of the different machines used in the manufacture of springs, such as plain and universal coiling, setting, helical, cutting and hooking and torsion spring machines. In each of the bulletins illustrations are also given of the various kinds of springs that are made by the different machines.

Portable Electric Tools.—Hisey-Wolf Machine Company, Cincinnati, Ohio. Folder. Treats of a line of portable electric tools, including tool post, parallel and internal grinding machines and electric drills of various types. All of these are illustrated and briefly described.